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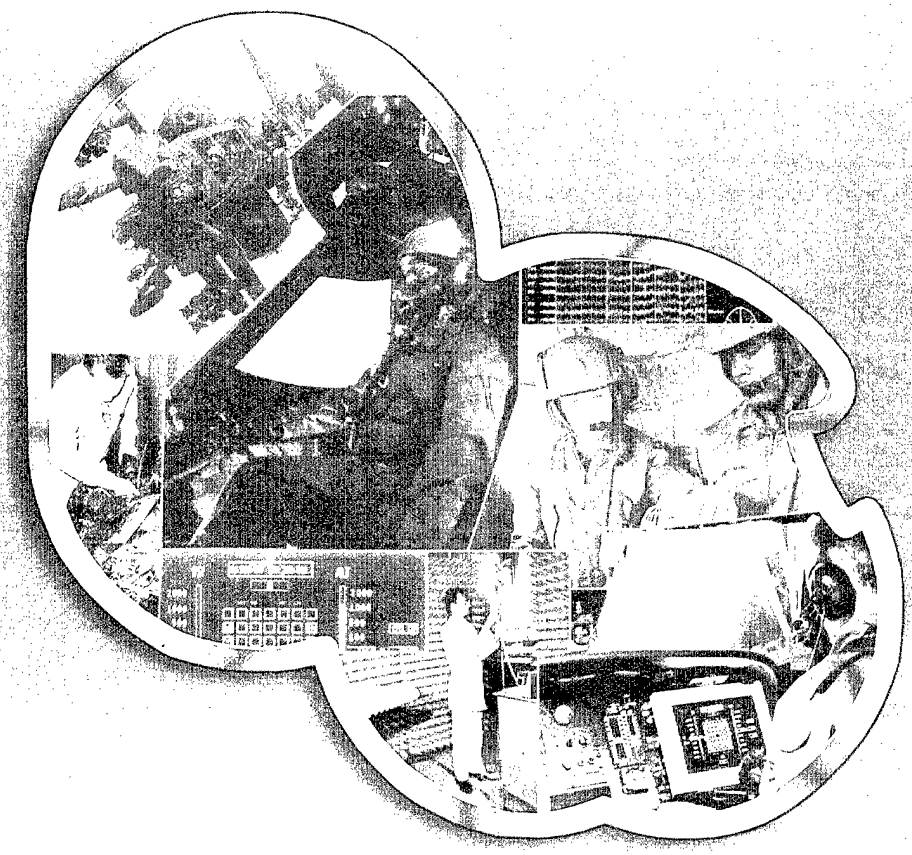
Hearing Protection of the Topowl® Helmet-Mounted Sight and Display System with the Communications Earplug

by William A. Ahroon, Elmaree Gordon, Melinda Hill, and Martin B. Robinette



Aircrew Protection Division

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USAARL

U.S. Army Aeromedical Research Laboratory

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William A. Ahroon, Elmaree Gordon, Melinda Hill, and Martin B. Robinette

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The Thales Avionics Topowl® Helmet Mounted Sight and Display System (HMSD) with and without the Communications Earplug (CEP) was tested for sound attenuation using American National Standards Institute (ANSI) standard S12.6-1984 and ANSI S12.6-1997 (R2002). Insertion loss measurements were made for the HMSD without the CEP in accordance with ANSI S12.42-1995 (R1999). The Thales Avionics Topowl® HMSD worn without the CEP does not meet the Navy/Marine Corps sound attenuation requirement but exceeds the requirement when worn with the CEP. When worn without the additional hearing protection afforded by the Communications Earplug or other passive earplugs, aircrew wearing the Thales Avionics Topowl® HMSD would be at risk due to higher noise exposure and reduced speech intelligibility, hence reduced operational capabilities. Expandable-form or preformed earplugs could be employed with the Thales Avionics Topowl® HMSD to meet the Navy/Marine Corps hearing protection requirements. However, these types of earplugs will compromise speech intelligibility and, thus, negatively impact crew performance. The U.S. Army Aeromedical Research Laboratory recommends that Thales Avionics Topowl® HMSD not be used without the additional hearing protection and enhanced communications afforded by insert hearing protection and communication devices such as the CEP.

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Introduction

The Naval Air Warfare Center, Aircraft Division 4.6.3.1, Patuxent River, MD, requested that the U.S. Army Aeromedical Research Laboratory (USAARL) evaluate the noise attenuation of the Thales Avionics Topowl® Helmet-Mounted Sight and Display (HMSD) system (Figure 1), proposed for use in the Navy/Marine Corps AH-1Z Super Cobra helicopter. The Topowl® HMSD is a two-piece system consisting of a Basic Helmet (Figure 2, left) and a Display Module (Figure 2, right), which attaches to the Basic Helmet and contains the optics for the display and sighting system. This document reports the hearing protection provided by the Topowl® HMSD measured in accordance with (IAW) (a) American National Standards Institute (ANSI) S12.6-1984 (1984), (b) ANSI S12.6-1997 (R2002) (1997) real-ear attenuation at threshold (REAT), and (c) the ANSI S12.42-1995 (R1999) (1995) microphone-in-real-ear (MIRE) procedures.

Figure 1. Thales Avionics Topowl® HMSD.

Figure 2. Thales Avionics Topowl® HMSD Basic Helmet (left) and Display Module (right).

The Communications Earplug (CEP) is a device that provides the exceptional hearing protection of an expanding foam earplug while passing to the ear the clearest speech signal attainable. The CEP consists of a miniature receiver encapsulated in a plastic housing, which includes a threaded adapter used for attaching the replaceable earplug. The earplug tip has an internally-threaded insert channel that extends through the center from the base to tip, and mates with the threaded adapter on the transducer housing. The speech signal is delivered directly from the receiver into the occluded portion of the ear canal. The design of the CEP allows the transducer to be completely inside the external ear when properly inserted into the earcanal. The small wires used to connect the CEP to the communications system are highly flexible for comfort and small enough to minimize the potential for leakage when the wire is routed between the ear cup seal and the aviator's head. It is worn in combination with the aviator's helmet, thereby providing hearing protection that is similar to that provided by the combination of the helmet and expandable-foam plugs. This approach provides sound attenuation and speech intelligibility that is as good as any technique observed to date.

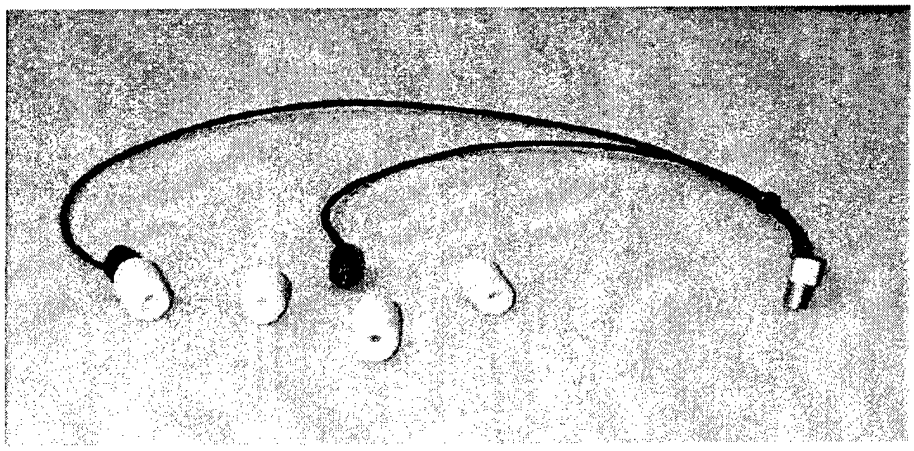

Figure 3. The Communications Earplug with three sizes of expandable-foam canal tips.

The CEP has undergone rigorous laboratory and engineering tests to verify that the design will meet the required levels of durability and performance that is expected of Army equipment. Results of testing have revealed CEP to be a miniature but durable device which possesses the attributes that will meet the challenge of military use. Tests have also shown the device is compatible with the various helmets and personal equipment ensembles used in Army aviation operational scenarios. Results of sound attenuation testing of the CEP alone by an independent laboratory show a noise reduction rating (NRR) of 29.5 dB. The CEP recently has been authorized for use by all Navy and Marine Corps rotary-wing aircraft and a NAVAIR publication is imminent (J. Wilt, personal communication, 26 August 2004). Therefore, the sound attenuation of the Topowl® HMSD was tested alone and with the CEP. One can safely assume that the noise attenuation of the Topowl® HMSD with another, similarly-performing earplug would be similar to the attenuation of the HMSD with CEP.

Methods

Testing was performed IAW ANSI S12.6-1984, modified for the Navy/Marine Corps requirement for minimum passive sound attenuating capability, which required the inclusion of 3000 Hz and 6000 Hz test signals (Par. 3.1.1.2)[1], ANSI S12.6-1997 (R2002) REAT using the Experimenter-supervised fit (Method A) procedure and ANSI S12.42-1995 (R1999)] using the MIRE procedure. ANSI S12.6-1984 specifies that measurements shall be summarized for at least each of the nine specified one-third octave bands test signals and three open/occluded trials ANSI S12.6-1997 (R2002) specifies using seven of the one-third octave-bands center test signals (Par. 4.1) and two open/occluded trials. REAT testing met the requirements of ANSI S12.6-1984 and ANSI S12.6-1997 (R2002).

Subjects

Twenty-five volunteer subjects (20 male, 5 female), recruited from tenant activities located at the U.S. Army Aviation Center, were used. The purpose of the study was explained to each subject. Each subject read and signed an informed consent form (Appendix A) and then completed a questionnaire regarding his/her hearing health (Appendix B). An otoscopic examination was performed and audiograms were collected on each subject before testing. At any time during this preliminary process, if a subject failed to qualify for ANSI S12.6-1984 or the -1997 (R2002) REAT testing, he/she was used only for MIRE evaluation or released. Three subjects failed to qualify due to excessive threshold variability, two of whom were used for the MIRE procedure and one, who also failed to qualify for the MIRE procedure due to excess system stability (ANSI S12.42-1995 Paragraph 8.2.3), and were released. Two other subjects qualified for the REAT procedure but failed to qualify for the MIRE. Twenty subjects completed the ANSI S12.6-1984 and -1997 (R2002) testing and 20 subjects completed the ANSI S12.42-1995 testing. Seventeen subjects completed testing using both methods. Subjects were permitted to withdraw from the study at any time without adverse action or penalty. Investigators adhered to Army Regulation (AR) 70-25 (Department of the Army, 1990) and USAMRMC Regulation 70-25 (Department of Defense, 1990) on use of volunteers in research during the conduct of this study.

Equipment

The REAT test procedure utilized Tucker-Davis Technologies (TDT) System II psychoacoustic test modules controlled by a general-purpose personal computer using custom-written software to control the real-ear procedure. Test stimuli were created by filtering the output of a WG2 Waveform Generator by a PF1 Programmable Filter and attenuating this signal with two PA2 Programmable Attenuators connected in series. The output of the WG2 was gated

[1] The ANSI S12.6-1984 standard requires hearing measurements at the octave center frequencies from 125 to 8000 Hz and at the half-octave center frequencies of 3150 and 6300 Hz. The acquisition requirements for the Topowl® HMSD required measurements at 3000 and 6000 Hz. For the purpose of this report, all references to data collected IAW the ANSI S12.6-1984 procedures will henceforth be referring to the evaluation using the 3000 and 6000 test frequencies.

on and off using a TG6 Timing Generator with 400 ms cycle time (two-and-one-half times a second, 50 percent duty cycle). The output of the attenuators placed in series was connected to QSC Audio PLX3402 Professional Power Amplifiers and routed to a speaker system consisting of three Altec Model 612C speakers. The sound field created by the system described satisfied the stimulus conditions mandated by ANSI S12.6-1984 and -1997 (R2002).

The MIRE test procedure utilized two Knowles Model 1832 electret microphones, two QSC Audio PLX 3402 Power Amplifiers, three Altec Model 612C speakers, and a personal computer running Microsoft Windows™ 2000 with National Instruments PCI-4451 Dynamic Signal Acquisition and Generation board (part number 777534-01) and a National Instruments LabVIEW™ software package installed. The sound field created by the system described satisfied the stimulus conditions mandated by ANSI S12.42-1995 (R1999). Control of the test procedure was performed by the Windows™-based computer system running custom LabVIEW software developed at the USAARL. The test system played broad-band white noise through one channel of the PCI-4451 Dynamic Signal Acquisition and Generation board. Ten seconds of sound were recorded from the two electret microphones through the two analog input channels of the PCI-4451 board. The LabVIEW software analyzed the input noise using the ANSI third-octave band tools available within the National Instruments Sound and Vibration Analysis Toolset and saved the results on disk for later analysis. The data acquisition system was calibrated daily with an acoustic reference signal produced by a Brüel & Kjær (B&K) Type 4228 pistonphone to provide sound pressure levels referenced to 20 micropascals (μPa), input through a B&K Type 4192 ½-inch microphone, coupled to a B&K Type 2669 preamplifier powered and conditioned by a B&K NEXUS Type 2690 conditioning amplifier.

Procedure

After preliminary screening including audiometric and anthropometric measurements (presented in Appendix K), subjects who were being used for ANSI S12.6-1984 and -1997(R2002) REAT evaluations were trained on the testing procedure. A custom TDT response box (RBOX) with six pushbuttons and two lights was used by the subjects to adjust the level of the signal (via the programmable attenuators). Subjects were given the instruction to "adjust the loudness of the signal until it is 'just barely audible'." Subjects satisfied the training and reliability requirements IAW ANSI S12.6-1997 (R2002) with at least three consecutive unoccluded third-octave audiograms with a range no greater than six decibels (dB).[2] Threshold during training and data collection was determined as the average of four consecutive judgments at a single test signal, with the condition that the range of these four judgments be no greater than five decibels. If response variability was large and this criterion was not reached after 20 judgments, the testing was paused and the subject was instructed on the use of the response box and reminded of the listening strategy. Subjects seldom required more than 20 trials to reach criterion with the vast majority of thresholds collected with less than 6 responses.

[2] The ANSI S12.6-1984 standard required variability of the three unoccluded measurements to be less than 5 dB.

The total noise exposure of the MIRE procedure for each subject was less than one minute for the entire experiment. For the unprotected ear, Department of Defense Instruction (DODI) 6055.12, "Hearing Conservation," (1991) limits allowable exposure time for a single 24-hour period for 105 dBA SPL (e.g., A-weighted SPL) to 15 minutes. The moldable earplug used in the measurement extended the maximum allowable exposure time to more than 16 hours. Thus, the subject's hearing was not considered at risk from the noise exposures encountered during this experiment.

Two helmet configurations were tested: the Thales Avionics Topowl® HMSD alone, and the Thales Avionics Topowl® HMSD with the Communications Earplug (CEP) (NSN 5965-01-474-5654) using ANSI S12.6-1984 and -1997 Method A, Experimenter-supervised fit. All conditions specified in ANSI S12.6-1984 -1997 were met, save the requirement that a separate product (helmet) be used for each subject. Rather, since the Thales Avionics Topowl® HMSD comes in one size only, two helmets were used in counterbalanced fashion with each subject using the same helmet for the entire test. Thirteen foam helmet liners were provided. Each subject selected the most appropriate size liner and the helmet was fit to the subject by USAARL Acoustics personnel trained by a Navy representative to properly fit the helmet. Each subject was given two pairs of foam eartips to use for the helmet with CEP trials, with the first pair used for the first and third occluded trials and the second pair used for the second occluded trial.

During each REAT test, three occluded and three unoccluded thresholds for each of the nine specified third-octave bands of noise centered at octave frequencies from 125 Hz to 8000 Hz, and at 3000 Hz and 6000 Hz, were obtained for each condition. A "trial" consisted of one occluded and one unoccluded measurement. The real-ear attenuation at threshold at each test center frequency was calculated as the average of the difference between the occluded and unoccluded thresholds for the three trials.

At the start of an ANSI S12.42-1995 MIRE test session, each subject was fitted with silicone moldable earplugs (Flents Products, Silaflex™ No. 901), that served both as a hearing protector and a convenient medium for mounting the Knowles microphones. The subject then was seated in the same hard-walled (reverberant) sound room used for REAT evaluations. A non-directional sound field of wideband noise at approximately 105 dBA sound pressure level (SPL) was presented and unoccluded reference data were collected. To obtain these data, the noise signal was measured by the microphones at the entrance of the subject's ears, the LabVIEW software performed the two-channel third-octave band analysis, and the results were stored by the computer for later analysis. Twenty-five third-octave bands with center frequencies from 63 Hz to 16,000 Hz were used. The sound field was then turned off and the subject donned the Thales Avionics Topowl® HMSD helmet. The sound field again was turned on and the noise signal was measured, analyzed, and stored in a like manner. The noise was measured, analyzed, and results stored after the subject doffed and donned the helmet two additional times, thus providing three measures of unoccluded and three measures of occluded noise levels for each subject. The algebraic difference between the mean of the three open and three occluded measurements for each one-third-octave band was defined as the insertion loss of the device IAW ANSI S12.42-1995. MIRE testing was performed on the Topowl® HMSD without CEP

since this procedure is not intended for use in the evaluation of insert or semi-insert hearing protective devices.

A reference device (ANSI S12.42-1995, Paragraph 8.1.5) consisting of a string suspended from the test booth ceiling down to a level approximately equal to the elevation of a subject's nose was used to maintain the subject's head at the stimulus reference point, the point where stimulus calibration was performed. During testing, subjects were observed over a closed-circuit television system.

Results

The mean REAT results for the Thales Avionics Topowl® HMSD alone and with CEP using the ANSI S12.6-1984 procedure are illustrated in Figure 4 and presented in tabular form in Table 1. The mean REAT results for the Thales Avionics Topowl® HMSD with CEP using ANSI S12.6-1997 (R2002) Method A are illustrated in Figure 5 and depicted in tabular form in Table 2. Individual results are presented in Appendices C through H. The acquisition requirements from the U.S. Navy and Marine Corps are depicted in both figures as that solid square symbols.

The Noise Reduction Ratings (NRR[3]) for the Topowl® HMSD alone and with the CEP are 0.3 dB and 16.9 dB, respectively. These values were calculated using the data obtained using current ANSI S12.6-1997 (R2002) standard test method. The values calculated using the older, ANSI S12.6-1984 standard were 2.3 dB and 16.1 dB, respectively.

The mean ANSI S12.42-1995 MIRE results are illustrated in Figure 6 and tabulated in Table 3. (The results of two different calculations of standard deviation are presented, differing in the degrees of freedom [*df*]. A discussion of the two calculations is located in Appendix I.) The dashed line in the figure depicts the real-ear attenuation at threshold also depicted in Figure 4. The individual and summary MIRE results are reported in Appendices I and J.

[3] The NRR is the "single number" descriptor of hearing protector performance under current EPA regulations.

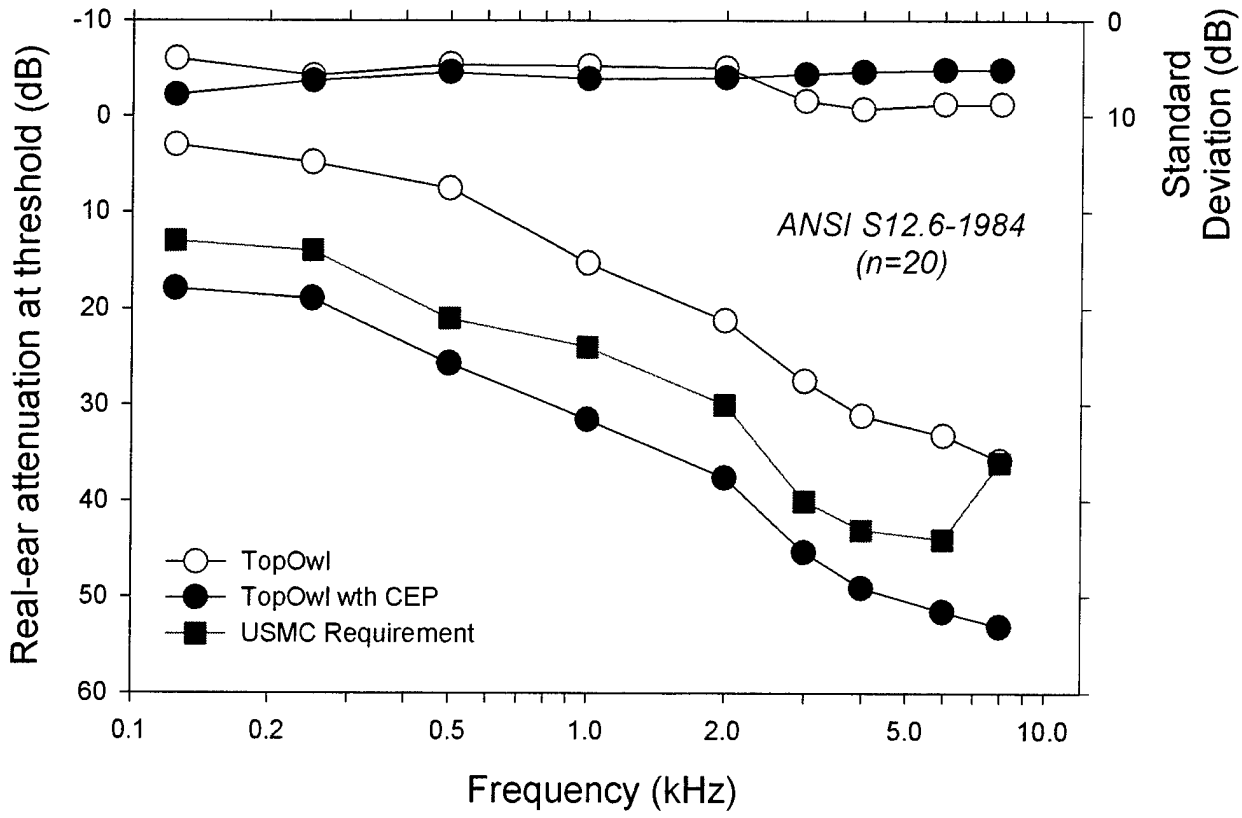

Figure 4. The mean (n=20) real-ear attenuation at threshold for the Thales Avionics Topowl® HMSD with and without the CEP using ANSI S12.6-1984.

Table 1.
The mean (n=20) real-ear attenuation at threshold for the Thales Avionics Topowl® HMSD with and without the CEP using ANSI S12.6-1984.

	Test frequency (kHz)								
	0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
	Thales Avionics Topowl® HMSD								
$\bar{X}$	3.00	4.88	7.55	15.34	21.22	27.54	31.11	33.16	35.82
s	3.95	5.75	4.60	4.77	4.93	8.40	9.27	9.22	8.79
	Thales Avionics Topowl® HMSD with CEP								
$\bar{X}$	17.88	18.95	25.69	31.52	37.60	45.31	49.09	51.54	53.05
s	7.75	6.32	5.38	6.11	5.98	5.63	5.36	6.56	5.16

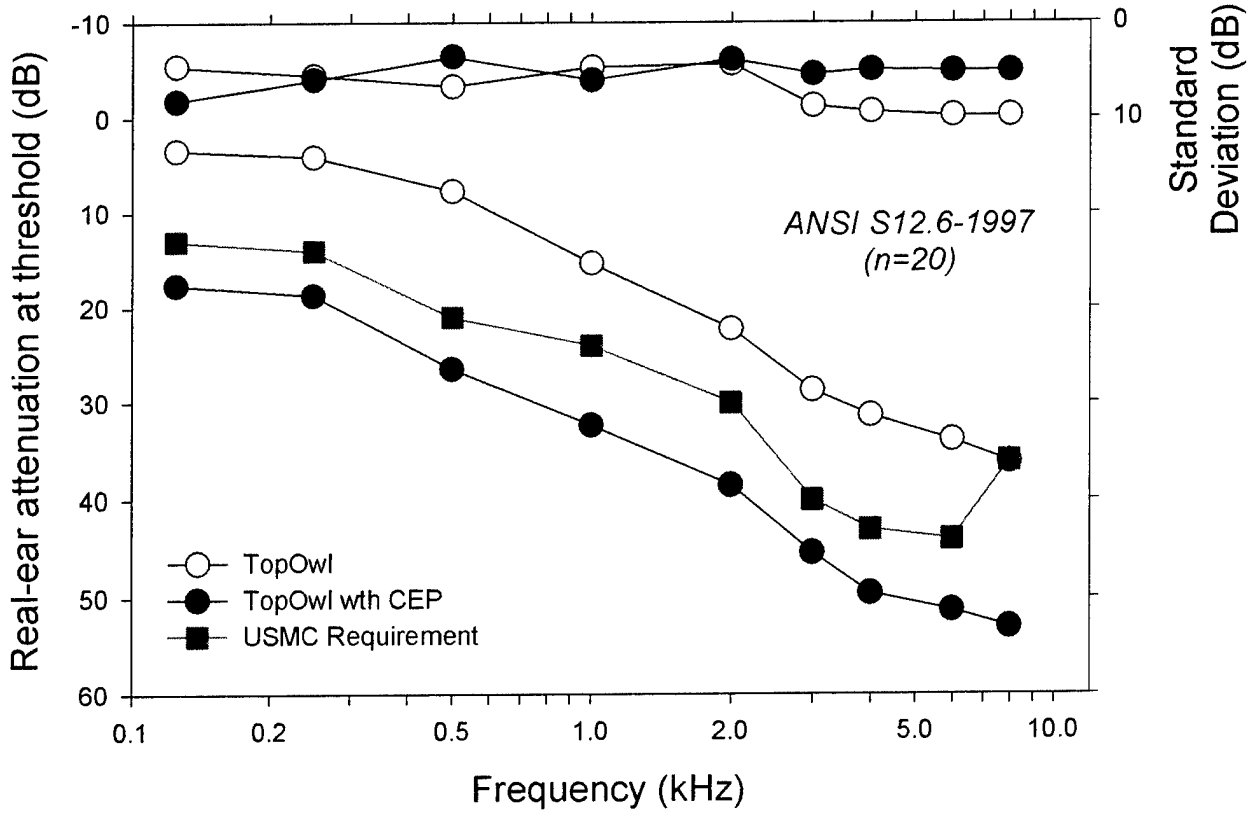

Figure 5. The mean (n=20) real-ear attenuation at threshold for the Thales Avionics Topowl® HMSD with and without the CEP using ANSI S12.6-1997 (R2002) Method A.

Table 2.

The mean (n=20) real-ear attenuation at threshold for the Thales Avionics Topowl® HMSD with and without the CEP using ANSI S12.6-1997 (R2002) Method A.

	Test frequency (kHz)								
	0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
	Thales Avionics Topowl® HMSD								
$\overline{X}$	3.43	4.09	7.68	15.34	22.24	28.69	31.35	33.89	36.13
s	4.60	5.55	6.68	4.67	4.33	8.78	9.36	10.23	9.79
	Thales Avionics Topowl® HMSD with CEP								
$\overline{X}$	17.68	18.71	26.47	32.32	38.53	45.39	49.54	51.28	53.04
s	8.23	5.99	3.60	6.02	3.90	5.43	4.96	7.35	5.11

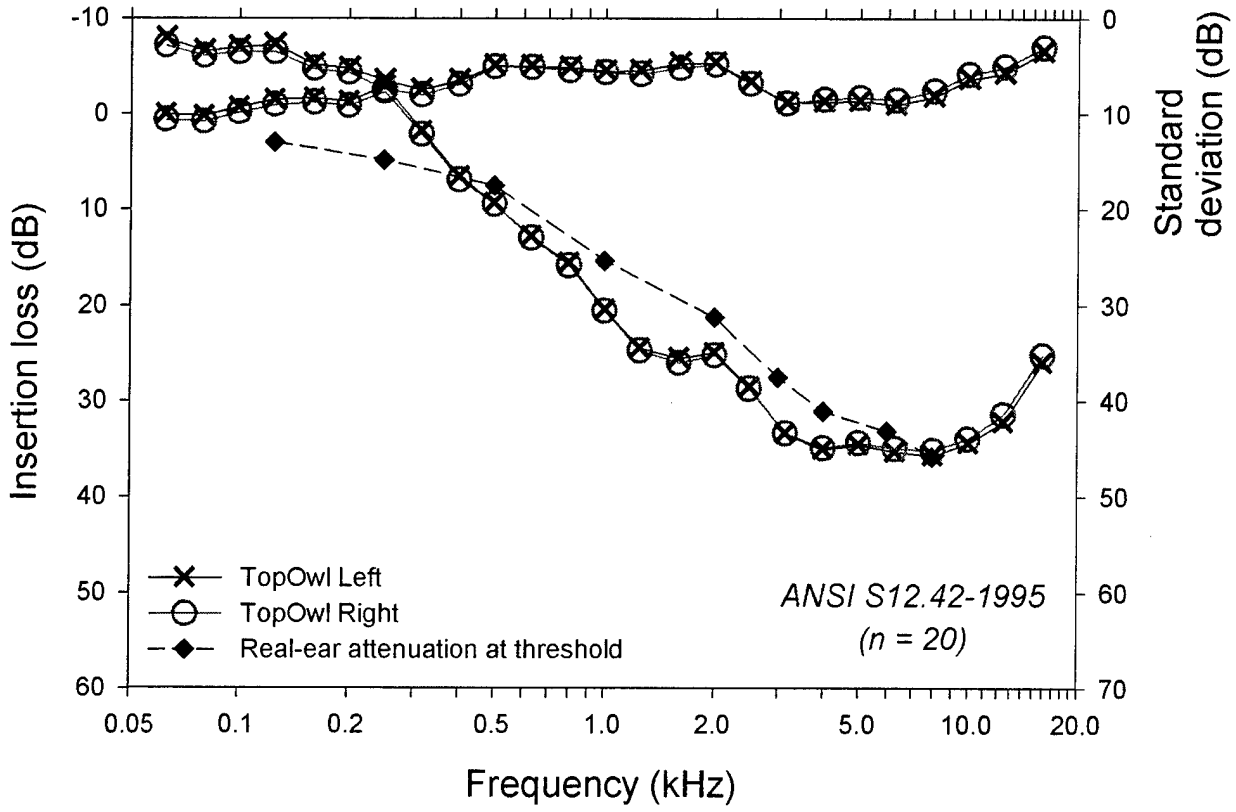

Figure 6. The mean (n=20) left-right ear average insertion losses for the Thales Avionics Topowl® HMSD.

Analysis of the MIRE data revealed a statistically significant main effect of test frequency (F=344.35, df = 24/456, $p < .05$) but no effect of ear (F=2.08, df = 1/19). The interaction of ear and test frequency was statistically significant (F=1.71, df = 24,456, $p < .05$) but an examination of within frequency comparisons using a Duncan multiple-range[4] test revealed that the left and right MIRE test results were statistically significantly different at the highest two test frequencies (12.5 and 16.0 kHz).

[4] The Duncan's multiple-range test was used for post-hoc comparisons because only a limited set of comparisons, those between mean insertion loss at the same frequencies, were of interest in these analyses (see Keppel, 1973).

Table 3.
The mean (n=20) insertion loss values for the Thales Avionics Topowl® HMSD using ANSI S12.42-1995 (R1999) MIRE procedure.

	Test frequency (kHz)								
	0.063	0.080	0.100	0.125	0.160	0.200	0.250	0.315	0.400
Left									
Mean	0.07	0.22	-0.68	-1.48	-1.66	-1.30	-2.94	1.82	6.66
$S_{(df=19)}$	2.09	3.42	3.03	2.72	4.79	5.20	6.51	7.50	6.47
$S_{(df=59)}$	3.04	5.01	4.38	3.68	5.96	6.39	7.80	9.08	8.34
Right									
Mean	0.65	0.84	-0.15	-0.94	-1.22	-0.88	-2.35	2.14	6.97
$S_{(df=19)}$	2.86	3.90	3.49	3.47	5.26	5.64	7.43	7.99	6.91
$S_{(df=59)}$	2.98	4.47	3.95	3.63	5.67	5.95	7.07	7.55	7.02

	Test frequency (kHz)								
	0.500	0.630	0.800	1.000	1.250	1.600	2.000	2.500	3.150
Left									
Mean	9.40	12.87	15.60	20.42	24.50	25.52	24.95	28.54	33.41
$S_{(df=19)}$	4.96	5.00	5.14	5.55	5.51	4.69	4.65	6.67	8.91
$S_{(df=59)}$	7.01	6.48	6.38	6.64	6.81	5.63	5.98	7.84	10.26
Right									
Mean	9.48	12.96	15.81	20.54	24.74	26.02	25.23	28.72	33.36
$S_{(df=19)}$	5.02	5.09	5.38	5.65	5.80	5.18	4.83	6.84	8.87
$S_{(df=59)}$	6.70	7.82	8.86	10.55	12.29	12.66	12.11	14.17	16.56

	Test frequency (kHz)								
	4.000	5.000	6.300	8.000	10.000	12.500	16.000	LIN	A-weight
Left									
Mean	35.08	34.57	35.32	35.74	34.45	32.23	26.03	8.61	17.81
$S_{(df=19)}$	8.74	8.65	9.06	8.22	6.37	5.77	3.45	4.14	5.41
$S_{(df=59)}$	10.54	10.59	10.80	9.71	7.29	7.01	4.15	5.00	6.51
Right									
Mean	34.90	34.37	34.95	35.17	33.96	31.41	25.26	9.09	18.16
$S_{(df=19)}$	8.51	8.31	8.56	7.59	5.84	5.04	3.02	4.81	5.87
$S_{(df=59)}$	16.93	16.73	16.94	16.38	15.51	13.54	10.22	5.92	9.65

Discussion

Noise health hazard assessment (HHA) for the Navy/Marine Corps AH-1Z Super Cobra will result in the promulgation of operational limits for aircrew flying this aircraft. These limits will be determined using (1) the octave-band noise levels in the aircraft and (2) the hearing protection measures from ANSI S12.6 testing. Since the aircraft noise levels are not available at the present time, HHA will have to wait until these measurements become available. However, the use of the CEP in the Navy/Marine Corps AH-1Z Super Cobra will considerably reduce the noise exposure of the aircrew and should also greatly improve speech intelligibility through improved speech-to-noise ratios (Mozo and Murphy, 1997). Since the Navy/Marine Corps AH-1Z Super Cobra may have significantly more complex auditory warning, cautions, and alerts (WCA) than current Navy/Marine Corps rotary-wing aircraft, the use of the CEP should be required unless it is demonstrated that cockpit noise does not interfere with WCA detection and recognition.

As noted above, the CEP currently is authorized in all U.S. Navy and Marine Corps rotary-wing aircraft. The authorized version of the CEP uses a slightly smaller transducer than is depicted in Figure 1. The smaller transducer has been implemented to better fit under the earcup of the Navy HGU-84/P Rotary Wing Helmet System used by U.S. Navy Aircrew. (The earcup volume of the HGU-84/P is smaller than the volume of the HGU-56/P Aircrew Integrated Helmet System used by most U.S. Army rotary-wing aircrew.) Since the same sized Comply™ Canal Tips are used with the standard CEP and the smaller CEP used in Navy and Marine Corps rotary-wing aircraft, the noise attenuation of the two versions of CEP would be the same.

Conclusions

The Thales Avionics Topowl® HMSD worn alone does not meet the Navy/Marine Corps sound attenuation requirement but exceeds the requirement when worn with the CEP. When worn without the additional hearing protection afforded by the Communications Earplug (Mozo & Murphy, 1997), aircrew wearing the Thales Avionics Topowl® HMSD would be at risk due to higher noise exposure and reduced speech intelligibility, hence reduced operational capabilities. Expandable-foam or preformed earplugs could be employed with the Thales Avionics Topowl® HMSD to meet the Navy/Marine Corps hearing protection requirements. However, these types of earplugs will compromise speech intelligibility and, thus, negatively impact crew performance. USAARL recommends that Thales Avionics Topowl® HMSD not be used without the additional hearing protection and enhanced communications afforded by insert hearing protection and communication devices such as the CEP.

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Appendices

Appendix A. Volunteer agreement affidavit

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Appendix G. Occluded and unoccluded thresholds for each trial of the Thales Avionics Topowl® HMSD using ANSI S12.6 real-ear attenuation at threshold

Appendix H. Occluded and unoccluded thresholds for each trial of the Thales Avionics Topowl® HMSD and CEP using ANSI S12.6 real-ear attenuation at threshold

Appendix I. Microphone-in-real-ear insertion loss summary results

Appendix J. Microphone-in-real-ear insertion loss individual subject results

Appendix K. Subject head and ear measurement demographics and fitting notes

Appendix A.

Volunteer agreement affidavit.

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 70-25 or AR 40-38; the proponent agency is OTSG.

PRIVACY ACT OF 1974

Authority: 10 USC 3013, 44 USC 3101, and 10 USC 1071-1087

Principal Purpose: To document voluntary participation in the Clinical Investigation and Research program. SSN and home address will be used for identification and locating purposes.

Routine Uses: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; adjudication of claims; and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State, and local agencies.

Disclosure: The furnishing of your SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your voluntary participation in this investigational study.

PART A -- VOLUNTEER AFFIDAVIT

Volunteer Subjects in Approved Department of Army Research Studies

Volunteers under the provisions of AR 40-38 and AR 70-25 are authorized all necessary medical care for injury or diseases which is the proximate result of their participation in such studies.

I, _____ SSN _____,

having full capacity to consent and having attained my _____ birthday, do hereby

volunteer to participate in *the research protocol, "Sound Attenuation of the Thales Avionics Topowl©*

Helmet with Communications Earplug"

under the direction of *William A. Ahroon, Ph.D.*

conducted at *the United States Army Aeromedical Research Laboratory, Fort Rucker, AL 36362-0577*

The implications of my voluntary participation: duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by

Dr. Ahroon, Ms. Melinda Hill, or Ms. Elmaree Gordon

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights or study-related injury, I may contact

Dr. Patricia A. LeDuc

at *Human Subject Review Committee, U.S. Army Aeromedical Research Laboratory,*

Building 6901, P.O. Box 620577, Fort Rucker, Alabama 36362-0577 (334) 255-6872

I understand that I may at any time during the course of the study revoke my consent and withdraw from the study without further penalty or loss of benefits; however I may be required (military volunteer) or requested (civilian volunteer) to undergo certain examinations if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

PART B -- TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: *(Provide a detailed explanation in accordance with Appendix C, AR 40-38 or AR 70-25.)*

You will be participating in an experiment to assess the sound attenuation of the Thales Avionics Topowl® helmet being considered for use in the AH-1Z Super Cobra. Evaluations will include the helmet alone and the helmet worn with the Communications Earplug (CEP).

To participate in some portions of this study, you must have normal hearing relative to the definitions set by the American National Standards Institute. You will be given a hearing test by a certified audiologist or hearing conservationist before and after your participation in the study. You also will complete a general health screening questionnaire which will include questions on your hearing.

The evaluation will be in two parts. The time required to complete both parts of the evaluation will be approximately five (5) hours including training for the real-ear evaluation. You will be given appropriate rest breaks.

(1) Real-ear attenuation at threshold (REAT) evaluation.-- Following the hearing test, you will sit in a quiet room and listen for a very soft "beeping" or "chirping" sound. You will be given a control that will allow you to adjust the loudness of the sound. You will adjust the sound to a level that is just detectable. This is called your "threshold." Your threshold will be determined three times with the hearing protection in place and three times without the hearing protection. Time required to test each device is approximately one hour. One set of six thresholds (three with and three without hearing protection) will be collected using the helmet alone and another set of six thresholds will be collected while wearing the helmet with the CEP.

(2) Microphone-in-real-ear (MIRE) evaluation.--You will be fitted with earplugs and a miniature microphone will be attached to the outer portion at the earplug. A brief, but loud, sound will be presented from which you will be protected by the earplugs. Next, you will apply the hearing protective device and the procedure will be repeated. You will remove the hearing protective device and apply it a total of three (3) times for each ear, for each device tested. Time required to test each device is approximately 20 minutes.

No risk is anticipated for this study. Sounds presented in the REAT evaluation (Part 1) are soft and present no risk. Noise exposures in the MIRE evaluation (Part 2) are brief and are well within the allowable limits of 85 dBA for unprotected noise exposure set forth in DODI 6055.12 (1991). The earplugs worn during MIRE evaluations provide an additional margin of protection from overexposure. Previous studies of this type have not resulted in any particular discomfort or ill effects to the subjects involved. These tests are being conducted in an effort to develop more efficient hearing protective devices for use by military personnel who are exposed to high intensity noise. No personal benefit is to be expected by the subjects, except a free monitoring of his/her hearing sensitivity.

The data from your participation in the study will be kept as confidential as possible. Representatives of the U.S. Army Medical Research and Materiel Command may inspect the records of this test and evaluation. Group data will be summarized in reports, but your name will never be identified with any specific data. None of the information obtained from this study which identifies you in any way will be released to a public forum without your express consent.

I have received a copy of this volunteer consent form and have read and fully understand its contents. I am signing this form voluntarily.

☐ I do ☐ do not (*check one and initial*) consent to the inclusion of this form in my outpatient medical treatment record.

SIGNATURE OF VOLUNTEER DATE

PERMANENT ADDRESS OF VOLUNTEER PRINTED NAME OF WITNESS

SIGNATURE OF WITNESS DATE

Appendix B.

Volunteer screening questionnaire.

Volunteer Screening Questionnaire TOPOWL

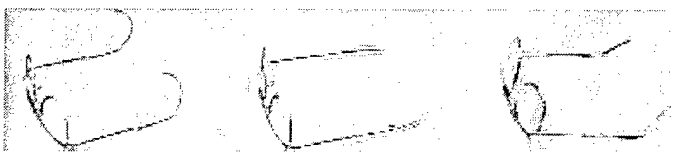
Name _____ SSN: _____

DOB: _____ Rank: _____ Gender: M / F

1.	Do you feel that you are currently in good health?	NO	YES
2.	Do you have any medical waivers, profiles or conditions?	NO	YES
3.	Have you ever had any problems with hearing?	NO	YES
4.	Have you ever had any problems with balance, dizziness, motion sickness, ear pain or ear discharge?	NO	YES
5.	Do you have any allergies?	NO	YES
6.	Are you currently suffering from any illnesses?	NO	YES
7.	Have you taken any medication within the past three days?	NO	YES
8.	Do you normally wear eyeglasses with your helmet?	NO	YES

a. If YES, what type temple arms or frames are on the glasses:

Cable [ ] (curved) Bayonet [ ] (straight) Skull [ ] (semi-curved) Not Sure [ ] (sketch shape)



9.	Do you normally wear earplugs with your helmet:	NO	YES

a. If YES, what type of earplugs do you wear with your helmet?

Foam [ ] Single flange [ ] Triple flange [ ] CEP [ ]

Selection Criteria

If not qualified, reason for disqualification

Literacy (English)	GO	NO-GO
Anatomical Features	GO	NO-GO
Otoscopic Inspection	GO	NO-GO
Pretest Audiogram	GO	NO-GO
Training	GO	NO-GO

_____

Principal Investigator's Signature & Date

Real-Ear Attenuation at Threshold Procedures – Method A

(1) Explain study and go over informed consent.

(2) Remove jewelry and glasses if necessary.

(3) Conduct otoscopic exam.

(4) Measure earcanal sizes and head dimensions.

Subject Measurements

Earcanal Size (L):	_____	Bitragion width:	_____ mm
Earcanal Size (R):	_____	Head height:	_____ mm
Topowl® Helmet:	_____	Liner:	_____

(5) Conduct screening audiogram.

Audiometric Screening (-10 to 20 dB HL)

Frequency (Hz)		125	250	500	1000	2000	4000	8000
Pre-test	L	_____	_____	_____	_____	_____	_____	_____
(dB HL)	R	_____	_____	_____	_____	_____	_____	_____

_____

Audiologist/CAOHC Tech Signature & Date

(6) Conduct training with minimum of 5 open-ear sound-field audiograms.

(7) Ensure subject meets selection criteria.

---

(8) **Outside chamber**: Help the subject size and fit; may give verbal and physical assistance and use fitting noise.

(9) Subject removes HPD and enters chamber.

(10) **Inside chamber**:

i. Begin with open-ear test or have the subject fit HPD using fitting noise, but with NO ASSISTANCE from the experimenter.

ii. Before actual testing, the experimenter may visually check fit and require refitting for "best fit."

iii. Two-minute quiet period, before first threshold, either before or after the HPD is fitted.

iv. Measure open and occluded thresholds.

(11) **Testing Sequence**: (Device, Order, Test sequence)

Topowl®	_____	G	Occluded, Open	G	Open, Occluded
Topowl® & CEP	_____	G	Occluded, Open	G	Open, Occluded
Topowl® MIRE	_____				

Appendix C.

Means and standard deviations of the real-ear attenuation at threshold of the Thales Avionics Topowl® HMSD using ANSI S12.6-1984 (*n*=20).

	Third-octave frequency band								
Subject	0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
01	1.08	4.92	8.92	19.17	22.75	32.75	42.00	44.75	42.33
02	13.08	17.50	18.83	13.75	27.00	23.17	37.17	33.58	48.92
03	2.50	15.00	5.00	6.92	17.75	20.17	18.67	20.92	24.33
05	5.83	5.50	7.42	18.58	27.83	28.67	28.75	30.25	32.08
06	-1.00	0.25	8.25	14.75	21.67	27.92	30.42	29.17	34.83
07	1.17	-0.67	7.33	18.08	22.83	32.83	39.67	40.08	43.67
08	-0.50	0.33	3.75	12.42	20.50	20.58	18.33	32.42	35.00
11	-0.08	2.17	8.58	16.58	21.92	32.08	38.08	41.00	43.50
12	4.25	7.08	10.67	20.25	27.75	34.75	40.92	42.17	41.92
13	-0.33	0.00	3.67	14.50	14.83	20.67	26.33	28.00	24.58
15	3.58	3.58	7.83	12.92	17.25	26.50	23.83	22.33	24.50
16	3.25	-0.50	8.58	19.92	24.17	30.92	33.58	27.83	28.33
17	3.25	5.00	10.50	15.75	17.42	20.42	23.17	31.92	37.75
18	-0.58	14.08	-4.92	11.50	10.17	17.08	22.67	25.92	30.92
19	2.25	1.58	8.50	10.75	18.17	22.67	24.42	29.33	31.17
20	0.08	-1.92	6.83	11.67	24.25	25.83	24.08	26.67	29.50
21	1.83	2.17	8.25	17.83	24.08	39.08	40.50	34.00	39.58
22	0.50	0.75	2.17	7.67	13.67	12.00	20.67	21.75	25.75
23	11.17	9.75	8.00	16.25	23.33	34.83	38.67	43.75	42.00
24	8.67	11.00	12.92	27.50	27.08	47.92	50.33	57.42	55.67
Mean	3.00	4.88	7.55	15.34	21.22	27.54	31.11	33.16	35.82
s	3.95	5.75	4.60	4.77	4.93	8.40	9.27	9.22	8.79

Appendix D.

Means and standard deviations of the real-ear attenuation at threshold of the Thales Avionics Topowl® HMSD using ANSI S12.6-1997 (R2002) Method A (n=20).

	Third-octave frequency band						
Subject	0.125	0.250	0.500	1.000	2.000	4.000	8.000
01	1.50	5.50	9.50	19.50	23.88	42.63	42.63
02	17.00	22.38	26.75	10.75	30.38	36.75	56.13
03	4.63	2.50	4.25	9.00	19.75	21.75	23.75
05	4.25	4.38	5.25	18.38	27.13	27.13	30.50
06	1.25	-0.88	8.13	14.50	22.75	30.63	33.75
07	1.75	0.38	7.25	18.38	21.50	41.13	43.88
08	-1.38	1.38	5.50	12.13	20.00	17.00	33.75
11	-0.13	3.00	8.63	16.25	23.13	38.50	45.63
12	5.00	6.63	12.25	20.75	27.88	41.88	42.50
13	-1.00	-0.50	3.88	13.88	15.25	25.13	25.50
15	4.25	4.00	8.75	12.00	17.75	24.63	25.50
16	2.75	-1.13	8.50	18.63	23.88	32.75	28.38
17	3.75	5.50	10.00	15.13	17.25	24.50	38.25
18	-0.13	1.13	-11.25	12.38	17.88	22.38	31.50
19	2.25	2.50	9.38	10.25	19.50	26.38	30.50
20	-1.13	-1.75	5.13	12.00	24.63	23.13	28.63
21	2.75	3.38	8.63	17.63	24.63	40.88	40.50
22	0.38	1.75	2.88	9.00	15.25	20.50	23.25
23	11.75	11.00	7.75	18.63	24.63	39.00	43.00
24	9.00	10.63	12.50	27.63	27.75	50.38	55.13
Mean	3.43	4.09	7.68	15.34	22.24	31.35	36.13
s	4.60	5.55	6.68	4.67	4.33	9.36	9.79

Appendix E.

Means and standard deviations of the real-ear attenuation at threshold of the Thales Avionics Topowl® HMSD & CEP using ANSI S12.6-1984 (*n*=20).

	Third-octave frequency band								
Subject	0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
01	23.75	27.17	24.17	38.25	41.67	48.75	53.75	57.67	61.83
02	19.92	22.25	28.25	32.75	39.17	48.50	44.33	56.00	56.83
03	21.50	21.25	24.25	22.67	35.58	36.42	40.33	40.00	48.42
04	27.17	27.75	28.92	40.25	41.75	46.50	50.83	59.17	57.50
06	13.50	14.17	27.92	31.92	39.50	50.33	51.92	54.92	55.75
07	27.25	21.50	26.08	30.25	31.00	36.17	47.50	51.83	57.08
08	19.08	20.08	29.08	30.25	40.33	42.75	46.33	55.25	55.75
11	11.42	16.33	30.25	33.25	43.33	58.17	55.33	56.25	62.08
12	24.33	22.58	23.67	36.33	39.75	42.50	55.83	51.50	43.83
13	25.00	21.17	34.17	44.00	41.42	46.58	48.25	55.83	54.33
15	15.58	19.42	29.00	28.50	36.83	42.25	44.50	49.25	47.17
16	7.17	8.83	25.58	31.83	40.83	52.00	51.25	56.42	54.50
17	4.17	6.92	19.42	20.83	29.67	41.08	44.92	51.58	53.17
18	4.00	7.50	7.92	19.50	18.83	40.92	45.75	33.08	47.08
19	11.75	15.25	24.50	27.50	33.17	39.75	36.83	44.58	48.08
20	21.00	20.08	30.00	33.83	38.25	47.08	52.33	50.58	50.00
21	25.83	24.00	27.75	33.67	42.08	46.08	54.08	51.92	50.08
22	16.25	17.83	24.33	27.33	40.58	44.17	48.67	45.75	51.50
23	27.92	29.42	27.42	34.42	33.92	42.33	51.50	50.67	47.67
24	11.08	15.58	21.17	33.08	44.25	53.92	57.58	58.58	58.25
Mean	17.88	18.95	25.69	31.52	37.60	45.31	49.09	51.54	53.05
s	7.75	6.32	5.38	6.11	5.98	5.63	5.36	6.56	5.16

Appendix F.

Means and standard deviations of the real-ear attenuation at threshold of the Thales Avionics Topowl® HMSD & CEP using ANSI S12.6-1997 (R2002) (n=20).

	Third-octave frequency band						
Subject	0.125	0.250	0.500	1.000	2.000	4.000	8.000
01	24.75	27.50	24.88	38.50	42.13	54.50	62.25
02	16.75	19.63	27.50	35.88	38.13	44.38	55.13
03	21.75	21.13	27.25	27.38	39.13	42.25	52.38
04	28.25	28.50	29.50	39.50	42.00	52.00	56.38
06	10.63	12.88	26.75	32.00	40.00	52.25	56.50
07	28.88	21.38	27.63	32.25	30.25	47.25	56.00
08	20.13	18.88	28.75	31.50	40.75	48.38	56.25
11	9.75	13.13	29.88	31.88	42.50	55.13	62.00
12	23.75	21.38	22.13	36.38	38.75	55.75	43.88
13	26.50	21.88	35.13	44.88	40.38	47.38	53.50
15	15.13	19.75	29.38	28.75	37.75	45.38	48.13
16	7.00	10.00	24.38	31.63	40.25	51.13	54.38
17	4.00	7.88	18.88	23.38	33.50	48.63	55.50
18	4.13	9.88	25.75	17.38	31.13	43.88	46.38
19	12.25	15.00	23.88	28.25	35.13	38.38	49.38
20	19.88	20.38	30.00	34.38	38.75	53.38	50.13
21	26.75	22.88	26.00	35.50	42.13	52.38	47.50
22	15.63	18.38	24.50	27.38	39.38	49.00	51.25
23	27.00	28.50	25.88	36.00	33.88	51.88	46.25
24	10.63	15.38	21.38	33.63	44.75	57.50	57.63
Mean	17.68	18.71	26.47	32.32	38.53	49.54	53.04
s	8.23	5.99	3.60	6.02	3.90	4.96	5.11

Appendix G.

Occluded and unoccluded thresholds for each trial of the Thales Avionics Topowl® HMSD using ANSI S12.6 real-ear attenuation at threshold.

			Third-octave frequency band (kHz)								
Condition	Subject	Trial	0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	01	1	44.00	37.50	18.00	-3.00	0.50	-6.00	2.25	6.75	8.75
Occluded	01	1	45.75	43.75	28.75	14.75	24.50	29.50	46.25	52.25	51.00
Unoccluded	01	2	43.75	34.00	20.75	-5.25	-2.50	-7.00	3.00	9.00	9.50
Occluded	01	2	45.00	38.75	29.00	16.00	21.25	26.50	44.25	53.00	52.50
Unoccluded	01	3	46.50	35.75	21.25	-4.75	-2.00	-5.00	3.50	8.75	8.75
Occluded	01	3	46.75	39.50	29.00	13.75	18.50	24.25	44.25	53.50	50.50
Unoccluded	02	1	39.75	35.00	20.25	-6.00	0.00	-3.25	4.50	9.25	7.75
Occluded	02	1	60.25	58.25	44.00	0.00	32.00	35.25	44.25	59.25	67.50
Unoccluded	02	2	44.00	34.75	15.75	8.00	7.25	7.50	15.00	12.50	13.50
Occluded	02	2	57.50	56.25	45.50	23.50	36.00	38.50	48.75	63.25	66.00
Unoccluded	02	3	50.00	40.25	33.75	2.75	5.50	-98.00	7.75	-98.00	20.50
Occluded	02	3	55.25	48.00	36.75	22.50	25.75	-98.00	45.75	-98.00	55.00
Unoccluded	03	1	38.25	31.00	20.00	-5.75	-3.25	-7.50	1.00	3.25	6.75
Occluded	03	1	40.50	31.00	22.00	7.00	19.00	15.25	21.75	25.25	29.00
Unoccluded	03	2	36.25	32.25	19.75	0.00	-0.75	-8.00	2.25	4.00	6.00
Occluded	03	2	43.25	37.25	26.25	5.25	16.50	16.25	25.00	26.00	31.25
Unoccluded	03	3	42.75	0.00	17.00	2.50	3.50	-2.50	6.75	7.75	6.75
Occluded	03	3	41.00	40.00	23.50	5.25	17.25	11.00	19.25	26.50	32.25
Unoccluded	05	1	50.25	43.00	30.50	0.25	6.00	1.75	6.00	10.50	15.25
Occluded	05	1	56.25	44.75	34.75	19.50	32.00	25.50	31.25	37.75	44.75
Unoccluded	05	2	52.00	44.75	32.50	0.50	5.75	-0.75	6.25	12.00	15.00
Occluded	05	2	54.50	51.75	38.75	18.00	34.00	29.25	35.25	41.50	46.50
Unoccluded	05	3	52.25	45.00	28.50	-0.25	3.50	-2.00	4.25	9.25	14.00
Occluded	05	3	61.25	52.75	40.25	18.75	32.75	30.25	36.25	43.25	49.25

Appendix G (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz)								
			0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	06	1	45.50	37.25	21.00	-3.25	-1.25	-9.00	1.50	10.50	15.50
Occluded	06	1	45.75	36.75	27.25	12.50	23.50	23.25	32.75	40.50	48.75
Unoccluded	06	2	48.25	40.25	25.25	-3.50	-1.00	-7.50	3.25	14.00	16.50
Occluded	06	2	50.50	39.00	35.25	9.75	19.75	22.25	33.25	44.75	50.75
Unoccluded	06	3	49.50	39.50	24.50	-2.75	1.50	-1.75	3.50	15.00	13.75
Occluded	06	3	44.00	42.00	33.00	12.50	21.00	20.00	33.50	41.75	50.75
Unoccluded	07	1	38.50	34.50	21.50	-9.00	-6.00	-10.25	-5.25	4.75	6.50
Occluded	07	1	40.50	34.25	29.75	9.75	13.00	23.25	37.00	44.50	50.50
Unoccluded	07	2	40.25	36.50	21.50	-6.50	-4.00	-7.25	-2.50	6.50	7.75
Occluded	07	2	41.75	37.50	27.75	11.50	20.00	26.25	37.50	47.00	51.50
Unoccluded	07	3	40.25	36.00	20.25	-8.25	-4.50	-6.50	-2.25	7.00	7.25
Occluded	07	3	40.25	33.25	27.75	9.25	21.00	25.00	34.50	47.00	50.50
Unoccluded	08	1	46.00	39.50	26.25	1.75	8.00	6.00	15.00	20.00	21.50
Occluded	08	1	45.00	41.75	33.00	14.00	30.00	25.50	32.00	53.00	55.50
Unoccluded	08	2	44.50	41.50	25.75	2.00	9.00	6.00	14.50	19.75	20.50
Occluded	08	2	42.75	42.00	30.00	14.00	27.00	25.75	31.50	51.25	54.00
Unoccluded	08	3	44.50	40.25	30.75	-0.25	7.50	4.75	13.00	18.25	19.50
Occluded	08	3	45.75	38.50	31.00	12.75	29.00	27.25	34.00	51.00	57.00
Unoccluded	11	1	35.00	26.50	9.75	-11.50	-5.00	-14.00	-11.50	-2.50	0.75
Occluded	11	1	34.50	30.50	21.50	3.25	15.00	18.50	27.25	41.50	44.50
Unoccluded	11	2	34.25	28.00	13.50	-12.00	-8.25	-14.50	-7.25	0.75	2.00
Occluded	11	2	34.50	30.00	19.00	5.75	18.00	20.50	31.00	39.25	49.50
Unoccluded	11	3	33.75	28.25	14.00	-15.25	-5.50	-13.25	-7.75	0.50	3.25
Occluded	11	3	33.75	28.75	22.50	2.00	14.00	15.50	29.50	41.00	42.50

Appendix G (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz) 0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	12	1	38.00	29.75	14.00	-11.25	-3.75	-9.25	2.25	7.75	18.00
Occluded	12	1	42.75	35.25	26.75	8.75	23.75	26.75	43.50	51.25	63.75
Unoccluded	12	2	40.00	32.00	16.75	-9.00	-1.50	-7.00	0.75	9.50	18.25
Occluded	12	2	45.25	39.75	28.50	12.50	26.75	27.75	43.25	52.50	57.50
Unoccluded	12	3	37.25	29.75	17.50	-7.50	-2.75	-7.25	1.50	9.00	18.25
Occluded	12	3	40.00	37.75	25.00	11.75	24.75	26.25	40.50	49.00	59.00
Unoccluded	13	1	43.50	35.25	19.75	-8.00	2.00	-8.25	-2.50	2.00	6.00
Occluded	13	1	43.00	33.75	27.00	8.25	17.75	12.75	25.50	30.25	34.00
Unoccluded	13	2	43.25	36.25	24.00	-5.00	1.50	-7.00	1.50	5.50	7.75
Occluded	13	2	41.75	36.75	24.50	6.50	16.25	11.50	23.75	32.75	30.75
Unoccluded	13	3	42.75	36.25	24.75	-8.25	0.50	-10.50	-4.25	2.25	7.75
Occluded	13	3	43.75	37.25	28.00	7.50	14.50	12.00	24.50	30.75	30.50
Unoccluded	15	1	36.75	29.75	18.00	0.00	5.00	-7.00	0.75	4.75	10.50
Occluded	15	1	41.50	35.25	28.50	6.75	22.00	19.50	24.25	27.00	37.00
Unoccluded	15	2	34.50	31.25	18.50	-5.50	-0.75	-11.00	-1.25	4.25	10.00
Occluded	15	2	38.25	33.75	25.50	11.75	17.75	15.50	24.50	26.75	34.50
Unoccluded	15	3	36.00	29.50	17.50	-8.25	0.25	-12.00	-0.25	2.25	9.75
Occluded	15	3	38.25	32.25	23.50	6.50	16.50	14.50	22.00	24.50	32.25
Unoccluded	16	1	43.25	41.25	27.25	-0.50	0.75	-8.25	1.25	10.75	12.25
Occluded	16	1	46.00	40.75	36.25	18.00	24.75	25.25	38.50	38.50	40.75
Unoccluded	16	2	45.25	43.50	29.75	0.75	2.00	-5.75	3.00	10.25	12.25
Occluded	16	2	48.00	41.75	37.75	19.50	25.75	22.75	31.25	34.75	40.50
Unoccluded	16	3	46.00	44.00	29.50	0.25	2.75	-5.50	0.75	10.50	15.25
Occluded	16	3	50.25	44.75	38.25	22.75	27.50	25.25	36.00	41.75	43.50

Appendix G (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz) 0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	17	1	44.75	39.00	28.50	1.75	0.75	-8.50	-1.75	5.75	5.75
Occluded	17	1	49.75	44.75	38.75	15.25	20.50	14.25	26.50	37.25	45.25
Unoccluded	17	2	46.75	37.75	28.00	-2.00	1.00	-8.00	1.00	5.75	7.25
Occluded	17	2	49.25	43.00	37.75	14.75	15.75	11.75	21.75	36.25	44.25
Unoccluded	17	3	46.50	38.25	27.75	-0.25	1.50	-4.75	3.50	6.50	6.50
Occluded	17	3	48.75	42.25	39.25	16.75	19.25	14.00	24.00	40.25	43.25
Unoccluded	18	1	47.00	39.00	26.75	0.50	5.75	0.00	6.25	10.25	17.00
Occluded	18	1	49.00	42.00	28.50	12.00	21.25	15.25	26.75	35.50	45.50
Unoccluded	18	2	47.50	42.50	24.25	-2.00	1.25	-3.25	1.50	8.00	17.25
Occluded	18	2	45.25	41.75	0.00	11.25	21.50	15.00	25.75	34.75	51.75
Unoccluded	18	3	50.75	0.00	24.75	1.25	5.25	-2.25	1.75	6.25	17.50
Occluded	18	3	49.25	40.00	32.50	11.00	0.00	15.50	25.00	32.00	47.25
Unoccluded	19	1	43.50	36.25	26.50	3.75	9.75	-0.25	8.25	16.75	18.50
Occluded	19	1	44.75	36.50	34.25	12.50	28.25	21.25	34.25	45.25	44.50
Unoccluded	19	2	41.50	37.75	26.00	8.50	9.75	3.50	10.75	16.25	18.00
Occluded	19	2	44.75	42.50	37.00	20.25	30.25	25.75	37.50	46.75	53.00
Unoccluded	19	3	43.25	37.00	26.75	4.25	12.50	0.25	11.75	18.25	16.50
Occluded	19	3	45.50	36.75	33.50	16.00	28.00	24.50	32.25	47.25	49.00
Unoccluded	20	1	47.75	36.75	19.50	-3.50	1.00	-4.00	6.25	15.25	20.75
Occluded	20	1	48.00	34.50	26.00	8.25	25.00	22.25	28.25	39.50	51.75
Unoccluded	20	2	51.00	40.00	22.00	-1.00	3.50	-3.75	6.50	14.00	22.75
Occluded	20	2	48.50	38.75	25.75	11.25	28.75	23.50	30.75	41.50	49.00
Unoccluded	20	3	47.75	39.75	18.75	-0.25	2.75	-2.25	4.25	14.75	18.50
Occluded	20	3	50.25	37.50	29.00	10.75	26.25	21.75	30.25	43.00	49.75

Appendix G (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz) 0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	21	1	40.00	34.25	20.50	-3.50	2.25	-7.75	-0.50	8.00	7.00
Occluded	21	1	43.75	36.50	30.00	15.25	23.75	32.50	45.75	45.00	45.50
Unoccluded	21	2	40.00	32.50	23.25	-3.00	-1.00	-6.00	4.50	8.50	6.25
Occluded	21	2	41.75	37.00	31.00	13.50	26.75	31.75	40.00	40.75	48.75
Unoccluded	21	3	40.75	35.50	21.75	0.50	1.50	-6.25	1.75	6.00	8.50
Occluded	21	3	40.75	35.25	29.25	18.75	24.50	33.00	41.50	38.75	46.25
Unoccluded	22	1	44.25	38.75	23.25	1.25	3.25	-4.50	1.75	11.25	12.50
Occluded	22	1	45.25	40.50	24.25	7.00	17.75	7.00	25.00	32.75	37.25
Unoccluded	22	2	44.25	37.50	20.75	-3.50	1.25	-5.00	3.00	11.50	14.25
Occluded	22	2	44.00	39.25	25.50	8.75	17.25	8.75	20.75	30.50	36.00
Unoccluded	22	3	43.25	37.00	23.25	-1.50	6.25	-4.50	4.50	12.75	13.00
Occluded	22	3	44.00	35.75	24.00	3.50	16.75	6.25	25.50	37.50	43.75
Unoccluded	23	1	42.00	36.25	22.75	-0.75	7.25	-1.00	4.00	15.50	19.50
Occluded	23	1	51.75	43.50	32.75	14.25	30.75	34.50	45.50	60.75	62.50
Unoccluded	23	2	43.25	35.75	25.25	0.00	8.75	-1.00	6.75	17.25	23.00
Occluded	23	2	50.00	42.25	30.00	15.75	29.75	32.75	40.00	55.75	61.50
Unoccluded	23	3	41.75	36.25	24.25	2.75	10.00	2.50	7.50	17.50	22.50
Occluded	23	3	58.75	51.75	33.50	20.75	35.50	37.75	48.75	65.00	67.00
Unoccluded	24	1	39.00	33.50	17.00	-10.75	-4.25	-12.25	-3.25	4.50	7.75
Occluded	24	1	47.50	43.75	29.75	18.25	24.50	36.75	47.25	63.00	63.50
Unoccluded	24	2	40.75	34.50	17.75	-8.00	-3.25	-11.75	-3.25	4.75	9.50
Occluded	24	2	50.25	45.50	30.00	18.25	23.50	37.75	47.00	61.25	64.00
Unoccluded	24	3	39.75	33.75	18.50	-9.25	-4.00	-10.00	-3.50	4.25	7.25
Occluded	24	3	47.75	45.50	32.25	18.00	21.75	35.25	46.75	61.50	64.00

Appendix H.

Occluded and unoccluded thresholds for each trial of the Thales Avionics Topowl® HMSD and CEP using ANSI S12.6 real-ear attenuation at threshold.

			Third-octave frequency band (kHz)								
Condition	Subject	Trial	0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	01	1	47.00	36.00	25.50	-1.75	-1.00	-5.50	3.00	10.50	10.75
Occluded	01	1	69.00	59.50	44.25	35.00	41.00	42.25	57.75	67.50	71.00
Unoccluded	01	2	43.75	35.00	23.25	-5.00	-1.50	-6.75	2.25	7.75	7.25
Occluded	01	2	71.25	66.50	54.25	35.25	40.75	43.25	56.50	67.25	71.50
Unoccluded	01	3	44.75	36.25	24.75	-2.25	0.75	-4.00	4.50	10.50	10.25
Occluded	01	3	66.50	62.75	47.50	35.50	41.50	44.50	56.75	67.00	71.25
Unoccluded	02	1	40.75	33.25	20.25	-6.00	1.25	-2.50	4.75	14.00	12.25
Occluded	02	1	62.75	57.50	47.50	32.25	43.75	44.75	48.25	62.75	67.00
Unoccluded	02	2	45.50	36.50	22.75	-2.75	11.50	-2.75	5.75	10.50	8.50
Occluded	02	2	57.00	51.50	50.50	30.75	45.25	47.00	51.00	66.00	64.00
Unoccluded	02	3	41.25	32.00	24.25	7.25	7.25	0.00	10.25	1.75	6.75
Occluded	02	3	67.50	59.50	54.00	33.75	48.50	48.50	54.50	65.50	67.00
Unoccluded	03	1	40.00	34.25	20.25	3.50	8.00	3.25	11.75	17.50	17.75
Occluded	03	1	57.25	57.50	48.50	27.25	43.25	42.25	50.75	54.50	67.75
Unoccluded	03	2	37.75	33.75	20.75	-3.50	-1.50	-4.75	5.75	9.75	13.25
Occluded	03	2	64.00	52.75	47.00	27.50	41.50	39.00	51.25	59.50	68.00
Unoccluded	03	3	41.75	35.00	24.75	11.00	16.75	13.75	14.25	26.00	28.50
Occluded	03	3	62.75	56.50	43.00	24.25	45.25	40.25	50.75	59.25	69.00
Unoccluded	04	1	43.50	34.75	23.50	-7.25	-5.25	-11.25	-2.75	5.75	9.25
Occluded	04	1	69.75	64.75	54.50	33.25	37.75	35.00	47.75	63.75	62.00
Unoccluded	04	2	41.25	36.50	25.75	-4.50	-3.25	-9.00	-1.50	6.75	10.25
Occluded	04	2	71.50	63.50	53.75	34.00	37.75	37.75	52.00	65.00	70.25
Unoccluded	04	3	42.50	37.00	26.50	-5.50	-2.75	-10.50	-1.50	4.50	10.00
Occluded	04	3	67.50	63.25	54.25	36.25	38.50	36.00	47.00	65.75	69.75

Appendix H (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz)								
			0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	06	1	50.75	42.00	24.50	-2.75	-1.00	-8.00	3.75	12.50	14.50
Occluded	06	1	65.50	56.00	51.75	28.50	40.50	41.25	51.25	65.25	69.00
Unoccluded	06	2	47.25	38.00	18.75	-2.25	0.75	-9.50	-1.25	10.75	11.25
Occluded	06	2	59.00	53.50	49.50	29.50	41.00	44.25	54.25	67.25	71.25
Unoccluded	06	3	46.25	39.25	21.50	-3.25	2.00	-7.00	0.00	10.75	14.75
Occluded	06	3	60.25	52.25	47.25	29.50	38.75	41.00	52.75	66.25	67.50
Unoccluded	07	1	35.50	34.00	18.25	-8.75	-3.25	-7.50	-4.25	5.25	5.75
Occluded	07	1	67.00	54.25	40.25	24.50	28.75	28.50	43.75	55.00	61.25
Unoccluded	07	2	39.50	33.25	16.25	-8.00	-5.25	-10.25	-2.00	2.00	4.25
Occluded	07	2	65.75	55.75	49.50	23.25	23.25	27.00	44.50	54.50	60.75
Unoccluded	07	3	39.50	34.25	17.00	-7.25	-5.25	-7.75	-3.50	4.00	3.75
Occluded	07	3	63.50	56.00	40.00	19.00	27.25	27.50	44.50	57.25	63.00
Unoccluded	08	1	43.50	40.50	22.25	-4.50	3.25	0.50	6.00	18.50	19.00
Occluded	08	1	64.75	58.00	54.25	27.00	42.25	45.25	57.00	74.00	75.75
Unoccluded	08	2	43.50	37.00	23.50	-2.75	3.75	5.50	12.50	18.00	20.00
Occluded	08	2	62.50	57.25	49.00	28.75	46.25	49.50	58.25	74.00	75.75
Unoccluded	08	3	45.50	37.75	28.75	1.50	7.50	6.25	14.50	19.75	21.75
Occluded	08	3	62.50	60.25	58.50	29.25	47.00	45.75	56.75	74.00	76.50
Unoccluded	11	1	36.25	28.75	13.50	-10.75	-8.25	-12.50	-7.00	2.75	2.25
Occluded	11	1	52.25	44.50	44.00	22.25	37.75	45.00	51.25	60.50	63.50
Unoccluded	11	2	36.75	30.25	14.25	-11.50	-5.00	-12.00	-6.00	3.00	3.00
Occluded	11	2	40.25	40.75	43.50	19.25	34.00	45.75	46.00	57.50	65.75
Unoccluded	11	3	35.25	27.25	14.50	-14.00	-6.00	-13.25	-6.25	2.50	0.50
Occluded	11	3	50.00	50.00	45.50	22.00	39.00	46.00	49.50	59.00	62.75

Appendix H (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz) 0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	12	1	36.25	29.25	16.00	-10.25	-3.50	-8.00	-2.25	4.50	19.50
Occluded	12	1	57.75	51.00	37.25	24.75	34.00	31.25	52.25	59.25	66.00
Unoccluded	12	2	36.00	31.50	14.50	-10.75	-4.25	-8.00	-1.00	5.50	20.00
Occluded	12	2	62.00	52.50	37.50	27.00	35.75	34.25	56.00	56.00	61.25
Unoccluded	12	3	36.50	30.50	16.25	-11.75	-3.75	-11.25	-1.00	6.50	18.00
Occluded	12	3	62.00	55.50	43.00	24.50	38.00	34.75	55.00	55.75	61.75
Unoccluded	13	1	41.75	34.75	19.75	-4.00	0.75	-8.25	0.50	1.50	6.00
Occluded	13	1	70.50	56.75	54.00	41.25	40.50	36.75	46.75	56.25	59.50
Unoccluded	13	2	42.00	33.75	19.50	-5.00	-0.25	-10.50	-1.00	1.50	5.50
Occluded	13	2	66.25	55.50	55.50	39.50	40.75	37.75	47.50	57.50	59.00
Unoccluded	13	3	42.00	34.50	19.75	-6.25	-0.25	-9.00	-3.00	2.75	6.50
Occluded	13	3	64.00	54.25	52.00	36.00	43.25	37.50	47.00	59.50	62.50
Unoccluded	15	1	36.25	29.25	15.75	-12.00	-2.00	-9.75	-2.25	-0.75	7.50
Occluded	15	1	50.00	46.25	46.50	21.75	36.00	32.25	46.50	49.25	55.25
Unoccluded	15	2	35.50	27.75	17.50	-4.75	-2.00	-10.00	0.25	3.50	8.50
Occluded	15	2	52.00	50.25	45.50	19.00	35.50	31.75	42.25	51.50	57.00
Unoccluded	15	3	36.50	29.50	18.00	-4.75	0.50	-8.75	2.75	3.25	7.75
Occluded	15	3	53.00	48.25	46.25	23.25	35.50	34.25	45.50	53.00	53.00
Unoccluded	16	1	45.75	42.25	27.75	0.75	3.00	-5.75	2.75	10.00	15.00
Occluded	16	1	53.50	50.25	49.25	32.75	42.25	45.25	52.50	65.75	69.25
Unoccluded	16	2	45.50	42.00	27.00	0.75	0.25	-8.75	2.50	9.25	13.75
Occluded	16	2	51.75	54.00	54.25	32.00	41.50	43.25	55.00	66.00	68.25
Unoccluded	16	3	45.50	44.00	26.50	-0.25	0.50	-8.50	4.00	9.75	12.50
Occluded	16	3	53.00	50.50	54.50	32.00	42.50	44.50	55.50	66.50	67.25

Appendix H (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz) 0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	17	1	45.25	38.50	24.75	-1.00	1.00	-9.00	-1.75	4.25	8.75
Occluded	17	1	48.75	42.75	40.75	22.50	34.25	35.50	47.25	58.00	65.00
Unoccluded	17	2	46.50	36.25	27.50	1.25	1.50	-6.75	-1.25	7.00	9.75
Occluded	17	2	51.00	47.75	49.25	24.50	35.25	37.00	47.00	60.50	64.50
Unoccluded	17	3	48.25	43.25	30.00	9.25	13.25	4.25	12.25	11.50	14.75
Occluded	17	3	52.75	48.25	50.50	25.00	35.25	39.25	49.75	59.00	63.25
Unoccluded	18	1	43.50	37.50	25.25	-0.25	5.25	-4.25	1.25	6.50	13.00
Occluded	18	1	49.50	48.50	39.75	23.25	34.25	34.00	46.25	57.75	68.25
Unoccluded	18	2	48.25	40.25	0.00	-0.50	1.25	-6.50	2.50	0.00	17.25
Occluded	18	2	50.50	49.00	37.00	10.75	34.50	35.50	45.25	0.00	54.75
Unoccluded	18	3	51.25	43.00	27.75	1.00	5.75	-4.50	3.75	9.25	18.00
Occluded	18	3	55.00	45.75	0.00	24.75	0.00	38.00	53.25	57.25	66.50
Unoccluded	19	1	45.50	35.50	26.25	3.75	10.50	5.00	12.00	19.25	17.25
Occluded	19	1	61.00	51.25	48.25	30.50	44.00	43.75	49.50	67.75	70.25
Unoccluded	19	2	48.75	38.75	28.00	3.00	7.75	5.00	14.00	15.75	18.50
Occluded	19	2	57.75	53.00	53.75	32.75	44.50	42.00	53.25	64.25	64.25
Unoccluded	19	3	47.25	37.25	30.50	9.00	15.25	5.25	16.75	24.75	21.50
Occluded	19	3	58.00	53.00	56.25	35.00	44.50	48.75	50.50	61.50	67.00
Unoccluded	20	1	47.25	36.25	19.75	-3.75	1.75	-4.75	3.50	13.50	17.50
Occluded	20	1	65.00	53.00	46.00	31.00	41.00	43.75	55.25	63.00	69.25
Unoccluded	20	2	47.50	36.25	19.25	-2.00	4.00	-2.50	3.25	13.75	19.50
Occluded	20	2	69.50	60.25	53.00	32.00	42.25	45.25	58.25	65.00	68.00
Unoccluded	20	3	46.50	38.50	20.75	-2.25	4.25	-0.75	6.00	13.75	19.00
Occluded	20	3	69.75	58.00	50.75	30.50	41.50	44.25	56.25	64.75	68.75

Appendix H (continued).

Condition	Subject	Trial	Third-octave frequency band (kHz) 0.125	0.250	0.500	1.000	2.000	3.000	4.000	6.000	8.000
Unoccluded	21	1	39.25	35.50	22.50	-4.25	2.25	-3.75	0.75	8.50	12.00
Occluded	21	1	66.75	60.25	50.75	31.75	42.00	42.50	58.50	62.50	65.50
Unoccluded	21	2	41.25	36.25	21.25	-3.50	1.00	0.50	5.75	10.50	14.50
Occluded	21	2	67.25	57.25	45.00	31.50	45.50	42.25	52.75	57.25	56.00
Unoccluded	21	3	42.50	36.25	21.25	-0.50	1.50	-7.25	3.75	7.00	10.25
Occluded	21	3	66.50	62.50	52.50	29.50	43.50	43.00	61.25	62.00	65.50
Unoccluded	22	1	44.00	37.75	22.00	-1.50	3.25	-6.50	4.50	12.50	11.50
Occluded	22	1	56.75	54.25	48.00	30.50	46.00	38.50	52.50	59.25	66.25
Unoccluded	22	2	43.75	36.25	23.00	2.75	4.75	-3.75	4.50	13.50	13.75
Occluded	22	2	62.25	56.50	46.00	25.50	40.75	36.25	54.50	57.25	61.50
Unoccluded	22	3	43.75	38.00	22.75	-1.75	4.50	-4.50	3.00	12.50	13.75
Occluded	22	3	61.25	54.75	46.75	25.50	47.50	43.00	51.00	59.25	65.75
Unoccluded	23	1	43.25	34.75	25.25	-1.75	8.00	2.00	6.00	17.50	24.25
Occluded	23	1	66.00	60.50	46.25	31.75	43.00	44.75	58.50	68.00	70.75
Unoccluded	23	2	44.00	36.25	23.50	1.50	11.25	2.00	7.75	18.25	23.50
Occluded	23	2	75.25	67.50	54.25	40.00	44.00	42.25	59.00	68.00	69.50
Unoccluded	23	3	44.00	38.00	24.25	2.00	9.50	0.75	5.75	16.75	21.50
Occluded	23	3	73.75	69.25	54.75	33.25	43.50	44.75	56.50	68.50	72.00
Unoccluded	24	1	39.00	34.00	16.00	-8.50	-5.00	-9.50	-4.50	5.75	7.00
Occluded	24	1	51.75	51.25	39.75	26.75	40.25	43.00	55.00	63.75	64.75
Unoccluded	24	2	37.00	33.75	16.00	-8.75	-3.75	-11.00	-3.75	4.00	8.00
Occluded	24	2	45.50	47.25	35.00	23.25	40.50	43.50	51.75	62.75	65.50
Unoccluded	24	3	40.50	34.25	17.25	-8.50	-3.50	-12.75	-5.00	5.00	7.25
Occluded	24	3	52.50	50.25	38.00	23.50	39.75	42.00	52.75	64.00	66.75

Appendix I.

Microphone-in-real-ear insertion loss summary results.

Note: Two different calculations for standard deviation are presented in Appendix Tables I-2 and I-3. The first calculation uses n-1 degrees of freedom (*df*) when $n = 20$, the number of subjects tested. The second calculation uses all 60 individual MIRE measurement in its calculation, thus $df = 59$.

The ANSI S12-42-1995 (R1999) is ambiguous in its reporting requirements. "The insertion loss at each ear for a hearing protective devices is the mean algebraic difference between the open and three occluded measurements at each third-octave test band for all subjects (MIRE) or for the three test runs (AFT) *(sic)*." The means are computed by averaging the insertion loss values for all subjects (MIRE) or three test runs (AFT) *(sic)* at each of the test bands," (Paragraph 10.1.1). One reading of this definition would result in a single open (unoccluded) measurement being computed for each ear and third-octave test band from the two, three, or four unoccluded measurements (Paragraph 8.2.3). Each of the three occluded measurements would in turn be subtracted from the single unoccluded mean measurement to yield three insertion loss measurements for each subject. These three insertion loss measurements contribute to the calculations of the descriptive analysis of the performance of the hearing protective device.

If three unoccluded measurements are made, however, a different calculation can be performed since the occluded and unoccluded measurements are now paired. In this design, used in the present evaluation, each of the paired unoccluded/occluded measurements can be used to calculate three separate insertion loss values, with these three values being averaged to compute a single value for the insertion loss for each ear. The standard deviation from these measurements will be computed with the number of subjects in the denominator of the formula for standard deviation, in this study, 20 subjects.

Thus, there are two different ways to perform the descriptive statistics summarizing the insertion loss measurements in ANSI S12.-42-1995 (R1999). The mean values of the insertion losses will not differ with the two different methods but the standard deviations are different due to differences in the sums of squares $[\sum(x - \bar{x})^2]$ and degrees of freedom (n - 1). Both values are reported in Tables I-2 and I-3.

If inferential statistical procedures were to be performed on this data, for example, comparing the insertion losses from the Thales Avionics Topowl® HMSD and another helmet, the most appropriate statistical approach for the calculation of standard deviation would be the second approach in which a single datum point is used for each subject's ear. This would permit repeated-measures analyses of variance without using subject as an additional repeated measure and thus appreciably complicating the analyses. The newer real-ear attenuation at threshold procedure specified in ANSI S12.6-1997 (R2002) uses the number of subjects, not observations, as the sample size (n) for determining degrees of freedom.

Table I-1. Summary results for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD (n=20).

	Third-octave band center frequency (kHz)												
Subject	**0.063**	**0.080**	**0.100**	**0.125**	**0.160**	**0.200**	**0.250**	**0.315**	**0.400**	**0.500**	**0.630**	**0.800**	**1.000**
01	0.05	-0.49	-1.51	-1.88	-1.12	0.26	3.73	11.28	14.50	13.52	17.20	20.90	25.58
02	4.02	4.08	3.41	4.47	5.35	6.83	8.58	14.84	18.23	15.67	15.99	22.50	27.17
03	-0.33	-0.91	-1.36	-2.13	-3.73	-4.33	-7.79	-5.87	-0.80	4.61	7.99	8.87	14.42
06	0.59	-1.12	-2.61	-3.98	-5.44	-7.13	-7.12	-2.38	5.47	7.46	13.57	17.06	21.12
07	6.00	13.16	10.24	6.29	14.18	14.04	15.55	21.51	22.83	24.43	27.35	28.00	32.86
08	-2.41	-2.26	-3.33	-4.40	-5.62	-2.31	-3.59	2.08	7.23	10.50	15.96	17.18	21.80
09	-1.50	-1.02	-1.98	-2.41	-3.06	-2.57	-6.16	-2.52	3.87	8.39	12.20	14.72	18.11
10	-1.49	-1.08	-1.49	-2.31	-4.07	-3.35	-9.07	-5.28	0.93	6.68	11.10	12.93	19.10
11	-1.17	-1.43	-2.35	-3.62	-5.22	-5.31	-6.45	-0.84	4.75	8.98	11.84	13.43	18.04
12	1.01	1.61	1.17	1.11	1.68	2.55	2.30	7.14	10.33	12.28	15.93	19.43	22.57
13	0.77	-0.84	-2.13	-3.34	-4.12	-6.09	-7.66	-3.59	4.60	6.71	8.60	10.61	15.93
15	-0.78	-1.00	-1.79	-2.64	-3.99	-3.93	-7.19	-2.54	2.94	6.05	11.26	12.57	17.40
16	-1.10	-1.54	-2.51	-3.71	-5.16	-4.63	-6.98	-0.47	5.87	9.92	13.06	15.09	19.77
17	-1.44	0.25	0.22	0.54	-0.61	1.31	-0.97	2.92	7.01	8.41	13.16	15.35	20.52
18	-0.22	-1.11	-1.91	-3.04	-4.40	-5.39	-8.16	-4.43	0.81	7.74	10.78	12.98	17.67
19	-0.01	-0.74	-2.10	-3.36	-4.34	-5.29	-7.52	-2.57	3.75	8.44	10.78	13.50	19.16
20	-1.78	-0.66	-1.67	-1.84	-3.10	-1.83	-7.83	-5.85	-1.56	5.54	9.24	13.95	18.76
22	1.60	-0.35	-0.53	-1.30	-2.16	-2.96	-3.34	-1.03	0.04	-0.11	1.22	4.69	6.80
24	4.68	4.93	3.55	3.40	6.02	7.65	8.12	12.83	16.47	13.46	16.65	22.24	28.78
25	0.72	1.07	0.34	-0.13	0.16	0.69	-1.35	4.39	9.05	10.07	14.37	18.04	24.05
Mean	0.36	0.53	-0.42	-1.21	-1.44	-1.09	-2.64	1.98	6.82	9.44	12.91	15.70	20.48
s	2.24	3.48	3.13	2.98	4.97	5.39	6.90	7.73	6.67	4.99	5.03	5.25	5.59

Table I-1. Summary results for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD (n=20).

	Third-octave band center frequency (kHz)												
Subject	**1.250**	**1.600**	**2.000**	**2.500**	**3.150**	**4.000**	**5.000**	**6.300**	**8.000**	**10.000**	**12.500**	**16.000**	**LIN**
01	32.13	32.77	28.85	34.84	44.28	45.33	46.14	47.57	47.58	41.22	38.46	29.13	11.44
02	29.82	27.23	26.22	32.50	40.23	45.54	48.49	45.63	40.45	40.00	35.00	26.18	15.91
03	21.08	22.90	22.92	21.44	24.49	22.17	21.69	21.99	26.43	24.57	22.00	19.68	6.16
06	26.21	29.63	28.27	34.58	38.14	38.47	35.77	33.97	35.66	36.99	37.45	27.88	5.42
07	34.56	32.00	34.80	39.44	45.11	49.10	48.19	48.24	46.80	43.03	34.02	24.31	19.96
08	25.61	28.50	29.93	34.29	41.24	38.92	37.91	37.22	33.25	35.86	34.59	25.55	7.78
09	20.27	19.90	21.88	24.98	27.39	29.46	26.91	28.39	31.79	29.01	28.41	26.95	7.48
10	23.55	24.20	25.28	27.02	31.67	30.67	30.19	33.85	36.57	32.10	30.06	25.61	5.80
11	23.04	26.19	25.24	30.31	37.36	38.18	36.92	42.51	42.22	40.27	39.72	32.89	6.84
12	27.05	25.95	27.72	30.22	32.77	33.51	34.36	34.33	33.06	34.25	33.45	27.54	12.73
13	21.13	26.64	21.83	26.54	32.61	32.60	33.39	33.04	33.40	27.90	26.77	24.20	6.01
15	23.85	22.98	23.86	24.32	29.10	31.89	30.65	30.17	29.60	31.14	25.96	21.05	6.50
16	24.71	27.22	25.13	33.81	39.17	39.36	36.80	34.22	36.74	37.36	36.10	28.05	7.96
17	24.17	21.65	20.84	21.17	25.60	29.09	31.01	31.97	32.91	31.77	29.61	24.52	9.98
18	23.35	26.36	24.51	27.60	28.14	29.54	28.75	33.03	36.16	36.02	30.42	26.86	4.33
19	25.21	25.20	25.49	28.03	27.72	30.36	28.75	29.33	33.06	35.66	32.73	25.68	4.76
20	18.86	21.97	24.13	26.05	25.30	26.04	25.70	26.56	21.55	24.80	26.46	26.89	5.80
22	8.10	11.86	10.50	8.93	10.61	18.49	20.37	17.73	21.31	22.60	22.21	20.80	5.10
24	31.09	31.13	28.64	35.21	46.70	50.29	48.13	51.03	51.66	42.15	36.97	24.20	16.64
25	28.60	31.18	25.70	31.34	40.10	40.84	39.20	41.83	38.82	37.38	36.07	24.92	10.38
Mean	24.62	25.77	25.09	28.63	33.39	34.99	34.47	35.13	35.45	34.20	31.82	25.64	8.85
s	5.64	4.88	4.72	6.74	8.89	8.62	8.47	8.79	7.86	6.07	5.26	3.01	4.41

Table I-2. Summary results for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – left ear only (n=20).

	Third-octave band center frequency (kHz)												
Subject	**0.063**	**0.080**	**0.100**	**0.125**	**0.160**	**0.200**	**0.250**	**0.315**	**0.400**	**0.500**	**0.630**	**0.800**	**1.000**
01	-0.81	-1.57	-2.76	-3.24	-2.30	-1.34	2.81	10.05	12.32	12.57	15.89	19.42	24.08
02	-0.95	-1.00	-0.67	0.41	2.09	4.22	3.68	12.91	17.25	15.83	16.42	21.88	27.52
03	-0.33	-0.91	-1.36	-2.13	-3.73	-4.33	-7.79	-5.87	-0.80	4.61	7.99	8.87	14.42
06	0.59	-1.12	-2.61	-3.98	-5.44	-7.13	-7.12	-2.38	5.47	7.46	13.57	17.06	21.12
07	6.00	13.16	10.24	6.29	14.18	14.04	15.55	21.51	22.83	24.43	27.35	28.00	32.86
08	-2.41	-2.26	-3.33	-4.40	-5.62	-2.31	-3.59	2.08	7.23	10.50	15.96	17.18	21.80
09	-1.50	-1.02	-1.98	-2.41	-3.06	-2.57	-6.16	-2.52	3.87	8.39	12.20	14.72	18.11
10	-1.49	-1.08	-1.49	-2.31	-4.07	-3.35	-9.07	-5.28	0.93	6.68	11.10	12.93	19.10
11	-1.17	-1.43	-2.35	-3.62	-5.22	-5.31	-6.45	-0.84	4.75	8.98	11.84	13.43	18.04
12	1.01	1.61	1.17	1.11	1.68	2.55	2.30	7.14	10.33	12.28	15.93	19.43	22.57
13	0.77	-0.84	-2.13	-3.34	-4.12	-6.09	-7.66	-3.59	4.60	6.71	8.60	10.61	15.93
15	-0.78	-1.00	-1.79	-2.64	-3.99	-3.93	-7.19	-2.54	2.94	6.05	11.26	12.57	17.40
16	-1.10	-1.54	-2.51	-3.71	-5.16	-4.63	-6.98	-0.47	5.87	9.92	13.06	15.09	19.77
17	-1.44	0.25	0.22	0.54	-0.61	1.31	-0.97	2.92	7.01	8.41	13.16	15.35	20.52
18	-0.22	-1.11	-1.91	-3.04	-4.40	-5.39	-8.16	-4.43	0.81	7.74	10.78	12.98	17.67
19	-0.01	-0.74	-2.10	-3.36	-4.34	-5.29	-7.52	-2.57	3.75	8.44	10.78	13.50	19.16
20	-1.78	-0.66	-1.67	-1.84	-3.10	-1.83	-7.83	-5.85	-1.56	5.54	9.24	13.95	18.76
22	1.60	-0.35	-0.53	-1.30	-2.16	-2.96	-3.34	-1.03	0.04	-0.11	1.22	4.69	6.80
24	4.68	4.93	3.55	3.40	6.02	7.65	8.12	12.83	16.47	13.46	16.65	22.24	28.78
25	0.72	1.07	0.34	-0.13	0.16	0.69	-1.35	4.39	9.05	10.07	14.37	18.04	24.05
Mean	0.07	0.22	-0.68	-1.48	-1.66	-1.30	-2.94	1.82	6.66	9.40	12.87	15.60	20.42
$s_{(df=19)}$	2.09	3.42	3.03	2.72	4.79	5.20	6.51	7.50	6.47	4.96	5.00	5.14	5.55
$s_{(df=59)}$	3.04	5.01	4.38	3.68	5.96	6.39	7.80	9.08	8.34	7.01	6.48	6.38	6.64

Table I-2. Summary results for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – left ear only (n=20).

	Third-octave band center frequency (kHz)												
Subject	**1.250**	**1.600**	**2.000**	**2.500**	**3.150**	**4.000**	**5.000**	**6.300**	**8.000**	**10.000**	**12.500**	**16.000**	**LIN**
01	30.78	29.91	26.87	33.16	44.23	46.23	46.34	48.84	50.21	43.11	41.76	32.30	10.17
02	28.78	25.13	25.43	32.40	40.83	46.39	50.29	48.06	43.51	43.01	39.89	30.72	12.38
03	21.08	22.90	22.92	21.44	24.49	22.17	21.69	21.99	26.43	24.57	22.00	19.68	6.16
06	26.21	29.63	28.27	34.58	38.14	38.47	35.77	33.97	35.66	36.99	37.45	27.88	5.42
07	34.56	32.00	34.80	39.44	45.11	49.10	48.19	48.24	46.80	43.03	34.02	24.31	19.96
08	25.61	28.50	29.93	34.29	41.24	38.92	37.91	37.22	33.25	35.86	34.59	25.55	7.78
09	20.27	19.90	21.88	24.98	27.39	29.46	26.91	28.39	31.79	29.01	28.41	26.95	7.48
10	23.55	24.20	25.28	27.02	31.67	30.67	30.19	33.85	36.57	32.10	30.06	25.61	5.80
11	23.04	26.19	25.24	30.31	37.36	38.18	36.92	42.51	42.22	40.27	39.72	32.89	6.84
12	27.05	25.95	27.72	30.22	32.77	33.51	34.36	34.33	33.06	34.25	33.45	27.54	12.73
13	21.13	26.64	21.83	26.54	32.61	32.60	33.39	33.04	33.40	27.90	26.77	24.20	6.01
15	23.85	22.98	23.86	24.32	29.10	31.89	30.65	30.17	29.60	31.14	25.96	21.05	6.50
16	24.71	27.22	25.13	33.81	39.17	39.36	36.80	34.22	36.74	37.36	36.10	28.05	7.96
17	24.17	21.65	20.84	21.17	25.60	29.09	31.01	31.97	32.91	31.77	29.61	24.52	9.98
18	23.35	26.36	24.51	27.60	28.14	29.54	28.75	33.03	36.16	36.02	30.42	26.86	4.33
19	25.21	25.20	25.49	28.03	27.72	30.36	28.75	29.33	33.06	35.66	32.73	25.68	4.76
20	18.86	21.97	24.13	26.05	25.30	26.04	25.70	26.56	21.55	24.80	26.46	26.89	5.80
22	8.10	11.86	10.50	8.93	10.61	18.49	20.37	17.73	21.31	22.60	22.21	20.80	5.10
24	31.09	31.13	28.64	35.21	46.70	50.29	48.13	51.03	51.66	42.15	36.97	24.20	16.64
25	28.60	31.18	25.70	31.34	40.10	40.84	39.20	41.83	38.82	37.38	36.07	24.92	10.38
Mean	24.50	25.52	24.95	28.54	33.41	35.08	34.57	35.32	35.74	34.45	32.23	26.03	8.61
$s_{(df=19)}$	5.51	4.69	4.65	6.67	8.91	8.74	8.65	9.06	8.22	6.37	5.77	3.45	4.14
$s_{(df=59)}$	6.81	5.63	5.98	7.84	10.26	10.54	10.59	10.80	9.71	7.29	7.01	4.15	5.00

Table I-3. Summary results for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD right ear only (n=20).

	Third-octave band center frequency (kHz)												
Subject	**0.063**	**0.080**	**0.100**	**0.125**	**0.160**	**0.200**	**0.250**	**0.315**	**0.400**	**0.500**	**0.630**	**0.800**	**1.000**
01	0.91	0.60	-0.26	-0.51	0.07	1.87	4.65	12.51	16.68	14.46	18.52	22.37	27.08
02	9.00	9.16	7.48	8.52	8.61	9.43	13.48	16.76	19.20	15.51	15.56	23.12	26.83
03	-0.33	-0.91	-1.36	-2.13	-3.73	-4.33	-7.79	-5.87	-0.80	4.61	7.99	8.87	14.42
06	0.59	-1.12	-2.61	-3.98	-5.44	-7.13	-7.12	-2.38	5.47	7.46	13.57	17.06	21.12
07	6.00	13.16	10.24	6.29	14.18	14.04	15.55	21.51	22.83	24.43	27.35	28.00	32.86
08	-2.41	-2.26	-3.33	-4.40	-5.62	-2.31	-3.59	2.08	7.23	10.50	15.96	17.18	21.80
09	-1.50	-1.02	-1.98	-2.41	-3.06	-2.57	-6.16	-2.52	3.87	8.39	12.20	14.72	18.11
10	-1.49	-1.08	-1.49	-2.31	-4.07	-3.35	-9.07	-5.28	0.93	6.68	11.10	12.93	19.10
11	-1.17	-1.43	-2.35	-3.62	-5.22	-5.31	-6.45	-0.84	4.75	8.98	11.84	13.43	18.04
12	1.01	1.61	1.17	1.11	1.68	2.55	2.30	7.14	10.33	12.28	15.93	19.43	22.57
13	0.77	-0.84	-2.13	-3.34	-4.12	-6.09	-7.66	-3.59	4.60	6.71	8.60	10.61	15.93
15	-0.78	-1.00	-1.79	-2.64	-3.99	-3.93	-7.19	-2.54	2.94	6.05	11.26	12.57	17.40
16	-1.10	-1.54	-2.51	-3.71	-5.16	-4.63	-6.98	-0.47	5.87	9.92	13.06	15.09	19.77
17	-1.44	0.25	0.22	0.54	-0.61	1.31	-0.97	2.92	7.01	8.41	13.16	15.35	20.52
18	-0.22	-1.11	-1.91	-3.04	-4.40	-5.39	-8.16	-4.43	0.81	7.74	10.78	12.98	17.67
19	-0.01	-0.74	-2.10	-3.36	-4.34	-5.29	-7.52	-2.57	3.75	8.44	10.78	13.50	19.16
20	-1.78	-0.66	-1.67	-1.84	-3.10	-1.83	-7.83	-5.85	-1.56	5.54	9.24	13.95	18.76
22	1.60	-0.35	-0.53	-1.30	-2.16	-2.96	-3.34	-1.03	0.04	-0.11	1.22	4.69	6.80
24	4.68	4.93	3.55	3.40	6.02	7.65	8.12	12.83	16.47	13.46	16.65	22.24	28.78
25	0.72	1.07	0.34	-0.13	0.16	0.69	-1.35	4.39	9.05	10.07	14.37	18.04	24.05
Mean	0.65	0.84	-0.15	-0.94	-1.22	-0.88	-2.35	2.14	6.97	9.48	12.96	15.81	20.54
$s_{(df=19)}$	2.86	3.90	3.49	3.47	5.26	5.64	7.43	7.99	6.91	5.02	5.09	5.38	5.65
$s_{(df=59)}$	2.98	4.47	3.95	3.63	5.67	5.95	7.07	7.55	7.02	6.70	7.82	8.86	10.55

Table I-3. Summary results for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – right ear only (n=20).

	Third-octave band center frequency (kHz)												
Subject	**1.250**	**1.600**	**2.000**	**2.500**	**3.150**	**4.000**	**5.000**	**6.300**	**8.000**	**10.000**	**12.500**	**16.000**	**LIN**
01	33.47	35.64	30.84	36.52	44.33	44.44	45.94	46.29	44.96	39.33	35.15	25.97	12.70
02	30.87	29.33	27.02	32.60	39.64	44.68	46.69	43.19	37.38	36.98	30.12	21.63	19.44
03	21.08	22.90	22.92	21.44	24.49	22.17	21.69	21.99	26.43	24.57	22.00	19.68	6.16
06	26.21	29.63	28.27	34.58	38.14	38.47	35.77	33.97	35.66	36.99	37.45	27.88	5.42
07	34.56	32.00	34.80	39.44	45.11	49.10	48.19	48.24	46.80	43.03	34.02	24.31	19.96
08	25.61	28.50	29.93	34.29	41.24	38.92	37.91	37.22	33.25	35.86	34.59	25.55	7.78
09	20.27	19.90	21.88	24.98	27.39	29.46	26.91	28.39	31.79	29.01	28.41	26.95	7.48
10	23.55	24.20	25.28	27.02	31.67	30.67	30.19	33.85	36.57	32.10	30.06	25.61	5.80
11	23.04	26.19	25.24	30.31	37.36	38.18	36.92	42.51	42.22	40.27	39.72	32.89	6.84
12	27.05	25.95	27.72	30.22	32.77	33.51	34.36	34.33	33.06	34.25	33.45	27.54	12.73
13	21.13	26.64	21.83	26.54	32.61	32.60	33.39	33.04	33.40	27.90	26.77	24.20	6.01
15	23.85	22.98	23.86	24.32	29.10	31.89	30.65	30.17	29.60	31.14	25.96	21.05	6.50
16	24.71	27.22	25.13	33.81	39.17	39.36	36.80	34.22	36.74	37.36	36.10	28.05	7.96
17	24.17	21.65	20.84	21.17	25.60	29.09	31.01	31.97	32.91	31.77	29.61	24.52	9.98
18	23.35	26.36	24.51	27.60	28.14	29.54	28.75	33.03	36.16	36.02	30.42	26.86	4.33
19	25.21	25.20	25.49	28.03	27.72	30.36	28.75	29.33	33.06	35.66	32.73	25.68	4.76
20	18.86	21.97	24.13	26.05	25.30	26.04	25.70	26.56	21.55	24.80	26.46	26.89	5.80
22	8.10	11.86	10.50	8.93	10.61	18.49	20.37	17.73	21.31	22.60	22.21	20.80	5.10
24	31.09	31.13	28.64	35.21	46.70	50.29	48.13	51.03	51.66	42.15	36.97	24.20	16.64
25	28.60	31.18	25.70	31.34	40.10	40.84	39.20	41.83	38.82	37.38	36.07	24.92	10.38
Mean	24.74	26.02	25.23	28.72	33.36	34.90	34.37	34.95	35.17	33.96	31.41	25.26	9.09
$s_{(df=19)}$	5.80	5.18	4.83	6.84	8.87	8.51	8.31	8.56	7.59	5.84	5.04	3.02	4.81
$s_{(df=59)}$	12.29	12.66	12.11	14.17	16.56	16.93	16.73	16.94	16.38	15.51	13.54	10.22	5.92

Appendix J.

Microphone-in-real-ear insertion loss individual subject results.

Table J-1. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 1.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.4	88.5	83.7	86.6	89.0	88.8	88.3	90.9	88.1	91.1	94.1	92.1	92.9
Test 2	87.7	88.8	82.9	85.6	88.9	87.8	89.2	91.7	90.5	92.3	95.0	91.3	92.0
Test 3	85.5	88.5	83.5	86.4	88.8	89.4	88.5	91.7	89.4	92.3	95.8	92.1	92.7
Mean	86.2	88.6	83.3	86.2	88.9	88.7	88.7	91.4	89.3	91.9	95.0	91.8	92.5
Occluded													
Test 1	86.3	89.8	86.2	90.1	93.0	93.3	89.9	84.8	78.6	80.6	80.1	74.0	69.3
Test 2	87.4	90.4	86.1	89.0	89.6	87.6	82.7	78.7	75.9	78.4	78.1	70.9	67.5
Test 3	87.3	90.4	86.1	89.2	91.0	89.2	85.2	80.6	76.5	79.0	79.0	72.3	68.5
Mean	87.0	90.2	86.1	89.4	91.2	90.0	85.9	81.4	77.0	79.3	79.1	72.4	68.4
Left Insertion Loss	**-0.8**	**-1.6**	**-2.8**	**-3.2**	**-2.3**	**-1.3**	**2.8**	**10.1**	**12.3**	**12.6**	**15.9**	**19.4**	**24.1**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	84.8	88.6	84.5	87.3	87.9	90.8	87.3	92.1	89.5	89.5	92.3	94.1	93.4
Test 2	87.3	89.1	84.2	86.6	87.4	87.2	87.1	92.7	91.4	91.5	94.1	92.8	93.8
Test 3	85.1	88.7	84.2	86.8	87.6	89.5	86.9	90.7	89.5	89.8	93.6	94.6	94.2
Mean	85.7	88.8	84.3	86.9	87.6	89.2	87.1	91.8	90.1	90.2	93.3	93.8	93.8
Error													
Occluded													
Test 1	81.7	84.5	80.6	82.3	81.4	82.7	77.8	73.0	70.8	74.1	73.8	69.5	65.2
Test 2	86.5	90.3	87.1	91.0	92.0	91.3	86.8	84.3	76.0	77.0	75.8	73.6	68.5
Test 3	86.2	89.8	86.0	88.9	89.4	87.9	82.8	80.6	73.5	76.2	74.7	71.2	66.5
Mean	84.8	88.2	84.5	87.4	87.6	87.3	82.5	79.3	73.4	75.8	74.8	71.4	66.7
Right Insertion Loss	**0.9**	**0.6**	**-0.3**	**-0.5**	**0.1**	**1.9**	**4.6**	**12.5**	**16.7**	**14.5**	**18.5**	**22.4**	**27.1**
Insertion Loss	**0.0**	**-0.5**	**-1.5**	**-1.9**	**-1.1**	**0.3**	**3.7**	**11.3**	**14.5**	**13.5**	**17.2**	**20.9**	**25.6**

Table J-1. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 1.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.8	94.8	95.7	97.4	98.1	100.7	98.5	96.0	95.7	91.8	91.4	83.9	108	108
Test 2	92.3	94.5	95.6	97.8	97.5	99.9	97.1	96.1	95.4	92.7	92.3	83.7	108	108
Test 3	92.7	94.7	96.6	97.3	97.9	100.2	98.8	96.3	96.7	93.7	92.2	85.0	108	108
Mean	92.6	94.7	96.0	97.5	97.8	100.3	98.1	96.2	95.9	92.7	92.0	84.2	108	108
Occluded														
Test 1	61.9	64.8	69.6	65.4	53.7	56.4	52.5	48.7	45.9	50.8	50.1	50.8	99	88
Test 2	61.0	63.8	67.7	63.6	53.2	51.5	51.1	46.2	45.4	48.0	50.2	52.6	97	84
Test 3	62.5	65.7	70.0	64.1	53.9	54.3	51.8	47.1	45.9	50.0	50.4	52.3	98	86
Mean	61.8	64.8	69.1	64.4	53.6	54.1	51.8	47.3	45.7	49.6	50.2	51.9	98	86
Left Insertion Loss	**30.8**	**29.9**	**26.9**	**33.2**	**44.2**	**46.2**	**46.3**	**48.8**	**50.2**	**43.1**	**41.8**	**32.3**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.4	93.1	95.0	97.1	98.9	100.7	98.7	96.6	95.4	91.6	90.2	83.3	108	108
Test 2	91.4	93.2	93.9	97.3	98.1	99.9	98.2	96.1	95.2	92.8	89.9	83.1	108	108
Test 3	91.4	93.9	95.6	97.3	97.7	100.0	99.3	97.5	96.5	92.1	90.5	83.2	108	108
Mean	91.4	93.4	94.8	97.2	98.2	100.2	98.7	96.7	95.7	92.2	90.2	83.2	108	
Occluded														
Test 1	56.2	57.9	64.0	61.2	51.9	51.4	49.9	49.3	50.0	52.8	55.5	57.9	91	79
Test 2	59.8	58.4	64.3	60.3	55.1	58.6	55.7	50.9	50.3	51.7	53.8	55.8	99	86
Test 3	57.8	57.0	63.7	60.7	54.8	57.4	52.9	51.0	52.0	54.0	55.8	58.0	96	83
Mean	57.9	57.8	64.0	60.7	53.9	55.8	52.8	50.4	50.8	52.8	55.0	57.2	95	83
Right Insertion Loss	**33.5**	**35.6**	**30.8**	**36.5**	**44.3**	**44.4**	**45.9**	**46.3**	**45.0**	**39.3**	**35.2**	**26.0**		
Insertion Loss	**32.1**	**32.8**	**28.9**	**34.8**	**44.3**	**45.3**	**46.1**	**47.6**	**47.6**	**41.2**	**38.5**	**29.1**		

Table J-2. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 2.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.6	89.0	83.9	87.1	89.4	91.0	88.7	94.7	92.6	92.7	93.8	93.2	94.3
Test 2	85.5	88.6	84.6	87.9	89.0	92.0	87.7	93.0	91.2	91.5	93.7	94.3	95.7
Test 3	85.7	88.7	84.4	87.5	89.1	91.9	87.9	93.2	90.9	92.2	94.9	94.2	95.9
Mean	86.3	88.7	84.3	87.5	89.2	91.6	88.1	93.6	91.6	92.1	94.1	93.9	95.3
Occluded													
Test 1	87.4	89.9	85.0	87.2	87.3	87.1	84.3	80.4	73.9	76.8	76.8	72.2	68.5
Test 2	87.0	89.6	84.8	86.8	86.8	87.3	84.4	80.4	74.3	76.4	77.8	71.8	66.9
Test 3	87.2	89.7	85.0	87.2	87.1	87.8	84.6	81.4	74.8	75.6	78.6	72.0	67.9
Mean	87.2	89.7	85.0	87.1	87.1	87.4	84.4	80.7	74.3	76.3	77.7	72.0	67.8
Left Insertion Loss	**-0.9**	**-1.0**	**-0.7**	**0.4**	**2.1**	**4.2**	**3.7**	**12.9**	**17.2**	**15.8**	**16.4**	**21.9**	**27.5**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.4	89.4	84.3	86.7	88.3	86.7	88.2	89.4	89.6	90.4	91.3	93.0	93.3
Test 2	85.4	88.9	84.3	86.6	88.0	89.5	87.0	89.8	88.5	89.7	93.1	94.7	94.4
Test 3	85.4	88.9	84.4	86.7	88.0	89.6	87.4	90.0	88.1	89.9	92.5	94.6	94.7
Mean	86.1	89.0	84.3	86.7	88.1	88.6	87.5	89.7	88.7	90.0	92.3	94.1	94.1
Error													
Occluded													
Test 1	74.1	78.3	76.2	77.6	78.5	79.0	73.9	71.7	70.6	75.0	76.6	70.7	68.0
Test 2	76.9	79.9	77.1	78.4	79.6	79.7	73.8	73.4	69.5	74.4	76.5	71.4	67.6
Test 3	80.2	81.4	77.2	78.5	80.3	78.9	74.5	73.9	68.4	74.2	77.1	70.8	66.3
Mean	77.1	79.9	76.8	78.2	79.5	79.2	74.0	73.0	69.5	74.5	76.7	71.0	67.3
Right Insertion Loss	**9.0**	**9.2**	**7.5**	**8.5**	**8.6**	**9.4**	**13.5**	**16.8**	**19.2**	**15.5**	**15.6**	**23.1**	**26.8**
Insertion Loss	**4.0**	**4.1**	**3.4**	**4.5**	**5.4**	**6.8**	**8.6**	**14.8**	**18.2**	**15.7**	**16.0**	**22.5**	**27.2**

Table J-2. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 2.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.5	94.5	96.1	97.7	98.7	100.8	99.3	96.3	91.0	93.0	87.3	77.6	108	109
Test 2	91.4	93.6	95.9	97.2	98.4	100.5	99.8	94.7	90.9	92.7	87.7	77.9	108	108
Test 3	92.8	94.9	96.5	97.4	98.2	100.5	99.7	93.9	93.1	93.4	87.8	80.4	108	108
Mean	92.2	94.3	96.2	97.5	98.4	100.6	99.6	95.0	91.7	93.0	87.6	78.6	108	108
Occluded														
Test 1	64.5	69.7	71.3	64.6	56.2	53.4	48.5	43.6	45.3	46.8	46.7	48.6	96	84
Test 2	63.1	69.1	70.5	66.0	58.6	54.9	51.6	52.8	55.0	57.5	51.0	47.8	96	84
Test 3	62.8	68.8	70.5	64.6	57.9	54.3	47.8	44.3	44.3	45.8	45.4	47.3	96	85
Mean	63.5	69.2	70.8	65.1	57.6	54.2	49.3	46.9	48.2	50.0	47.7	47.9	96	85
Left Insertion Loss	**28.8**	**25.1**	**25.4**	**32.4**	**40.8**	**46.4**	**50.3**	**48.1**	**43.5**	**43.0**	**39.9**	**30.7**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	90.8	92.8	95.4	97.1	97.6	99.7	99.0	95.9	91.8	90.5	84.6	78.4	107	108
Test 2	91.4	93.3	94.9	96.4	97.1	99.9	100.0	93.7	93.1	91.1	84.5	77.8	107	108
Test 3	91.0	92.4	93.4	96.8	96.3	98.6	98.9	93.9	93.4	90.3	85.1	78.7	107	107
Mean	91.1	92.8	94.6	96.8	97.0	99.4	99.3	94.5	92.8	90.6	84.7	78.3	107	
Occluded														
Test 1	59.8	63.4	68.3	64.0	57.8	54.2	51.0	49.0	54.2	53.1	54.9	57.0	87	80
Test 2	60.3	63.4	67.4	64.9	57.0	54.7	52.5	51.4	53.1	51.8	54.1	56.5	88	80
Test 3	60.5	63.7	66.9	63.6	57.3	55.2	54.3	53.6	58.9	56.0	54.9	56.5	89	80
Mean	60.2	63.5	67.6	64.2	57.4	54.7	52.6	51.3	55.4	53.6	54.6	56.7	88	80
Right Insertion Loss	**30.9**	**29.3**	**27.0**	**32.6**	**39.6**	**44.7**	**46.7**	**43.2**	**37.4**	**37.0**	**30.1**	**21.6**		
Insertion Loss	**29.8**	**27.2**	**26.2**	**32.5**	**40.2**	**45.5**	**48.5**	**45.6**	**40.4**	**40.0**	**35.0**	**26.2**		

Table J-3. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 3.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.4	89.9	85.1	87.8	89.5	88.2	87.7	90.0	88.8	90.4	93.3	94.1	95.3
Test 2	86.6	89.9	85.2	87.7	89.3	87.8	87.0	90.1	89.4	90.0	94.5	94.3	96.2
Test 3	88.8	90.0	84.4	86.6	89.7	84.5	88.8	90.3	90.5	91.6	95.2	93.7	94.3
Mean	87.3	89.9	84.9	87.4	89.5	86.8	87.8	90.1	89.5	90.7	94.3	94.0	95.3
Occluded													
Test 1	87.1	90.6	86.1	89.2	91.6	91.8	95.0	99.8	94.4	90.4	89.2	87.4	83.7
Test 2	86.9	90.1	85.6	88.7	91.8	90.9	96.0	98.8	92.7	91.2	90.7	86.3	82.9
Test 3	87.1	90.5	85.8	89.0	92.0	90.6	95.8	99.0	92.6	90.3	90.2	87.3	84.4
Mean	87.0	90.4	85.8	89.0	91.8	91.1	95.6	99.2	93.2	90.6	90.0	87.0	83.7
Left Insertion Loss	**0.2**	**-0.4**	**-0.9**	**-1.6**	**-2.3**	**-4.3**	**-7.8**	**-9.1**	**-3.7**	**0.1**	**4.3**	**7.0**	**11.6**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	84.8	88.8	84.9	87.8	88.1	93.1	88.6	92.1	91.1	92.1	92.4	92.4	93.9
Test 2	84.7	88.6	84.9	87.7	87.9	93.1	89.0	92.2	90.6	92.4	93.2	93.1	94.2
Test 3	87.2	89.0	84.7	86.9	87.1	89.8	90.2	93.6	91.2	92.3	92.8	93.3	93.9
Mean	85.6	88.8	84.8	87.5	87.7	92.0	89.3	92.6	91.0	92.3	92.8	92.9	94.0
Error													
Occluded													
Test 1	86.7	90.5	87.0	90.7	93.3	98.0	97.2	95.0	89.2	82.3	81.2	79.8	75.4
Test 2	86.2	89.9	86.4	89.9	92.5	95.4	96.8	95.2	88.7	83.8	81.2	84.0	77.8
Test 3	86.5	90.1	86.4	89.8	92.7	95.8	97.2	95.6	88.8	83.2	81.0	83.0	77.1
Mean	86.4	90.2	86.6	90.1	92.8	96.4	97.1	95.3	88.9	83.1	81.1	82.3	76.8
Right Insertion Loss	**-0.9**	**-1.4**	**-1.8**	**-2.7**	**-5.1**	**-4.4**	**-7.8**	**-2.7**	**2.1**	**9.2**	**11.7**	**10.7**	**17.2**
Insertion Loss	**-0.3**	**-0.9**	**-1.4**	**-2.1**	**-3.7**	**-4.3**	**-7.8**	**-5.9**	**-0.8**	**4.6**	**8.0**	**8.9**	**14.4**

Table J-3. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 3.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.3	96.6	96.8	99.5	100.0	103.8	101.2	98.0	95.1	86.3	85.5	77.7	110	110
Test 2	93.2	96.6	97.9	98.5	99.7	103.5	100.9	97.0	93.9	85.2	86.4	78.1	109	110
Test 3	91.8	95.2	96.8	98.2	100.6	102.7	100.5	96.8	94.9	87.1	87.5	80.1	109	110
Mean	92.4	96.1	97.2	98.7	100.1	103.3	100.8	97.3	94.6	86.2	86.5	78.6	109	110
Occluded														
Test 1	77.4	79.7	81.9	86.7	86.6	87.6	86.4	84.5	74.0	70.2	72.8	65.0	104	99
Test 2	75.6	75.7	77.7	80.2	76.9	82.0	81.3	80.6	71.2	57.9	65.0	57.3	104	98
Test 3	74.6	74.7	79.0	82.3	77.4	82.7	82.3	82.7	73.1	60.1	68.7	59.6	104	98
Mean	75.9	76.7	79.5	83.1	80.3	84.1	83.3	82.6	72.8	62.7	68.8	60.6	104	98
Left Insertion Loss	**16.6**	**19.4**	**17.7**	**15.6**	**19.8**	**19.2**	**17.5**	**14.7**	**21.8**	**23.5**	**17.7**	**18.0**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.9	93.8	95.9	98.3	100.2	102.5	102.0	99.0	96.0	84.2	84.8	78.0	109	110
Test 2	91.4	93.6	96.5	98.5	100.4	102.8	101.1	98.9	97.7	85.8	82.4	77.8	109	110
Test 3	92.1	94.8	96.9	98.2	100.8	102.6	100.9	99.3	98.9	86.3	82.1	78.3	110	110
Mean	91.8	94.1	96.4	98.3	100.5	102.7	101.3	99.1	97.5	85.4	83.1	78.0	110	
Occluded														
Test 1	65.3	69.3	67.6	70.6	73.1	79.5	77.7	72.2	67.7	59.0	56.9	56.6	103	95
Test 2	66.7	67.4	68.3	71.2	70.1	76.3	74.0	68.8	65.2	60.7	57.1	56.9	102	94
Test 3	66.6	66.3	68.7	71.4	70.7	76.8	74.6	68.3	66.6	59.6	56.5	56.5	103	94
Mean	66.2	67.6	68.2	71.1	71.3	77.6	75.5	69.8	66.5	59.8	56.8	56.7	103	94
Right Insertion Loss	**25.6**	**26.4**	**28.2**	**27.2**	**29.2**	**25.1**	**25.9**	**29.3**	**31.0**	**25.6**	**26.3**	**21.4**		
Insertion Loss	**21.1**	**22.9**	**22.9**	**21.4**	**24.5**	**22.2**	**21.7**	**22.0**	**26.4**	**24.6**	**22.0**	**19.7**		

Table J-4. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 6.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.9	88.6	82.6	85.2	89.2	87.2	89.9	89.9	90.6	92.2	94.1	92.7	92.5
Test 2	88.1	89.0	82.9	85.6	89.4	87.6	90.1	91.5	91.2	91.9	94.3	92.1	92.4
Test 3	86.0	88.9	83.7	86.7	89.3	87.2	89.3	90.0	90.1	91.2	94.8	93.2	92.7
Mean	87.3	88.8	83.1	85.9	89.3	87.3	89.8	90.5	90.7	91.8	94.4	92.7	92.5
Occluded													
Test 1	86.2	89.3	85.2	89.2	92.7	94.1	98.8	97.5	90.6	89.4	84.9	80.4	74.9
Test 2	86.4	89.6	85.4	89.2	93.1	93.6	98.7	97.5	90.0	88.9	85.6	80.3	75.4
Test 3	86.4	89.8	85.8	89.6	93.5	94.1	99.1	96.7	88.5	86.9	84.4	79.4	74.2
Mean	86.3	89.6	85.5	89.3	93.1	93.9	98.9	97.2	89.7	88.4	85.0	80.0	74.8
Left Insertion Loss	**1.0**	**-0.8**	**-2.4**	**-3.5**	**-3.8**	**-6.6**	**-9.1**	**-6.7**	**0.9**	**3.4**	**9.5**	**12.6**	**17.7**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.7	88.1	84.0	86.6	87.4	87.3	89.5	92.3	90.8	91.7	92.7	94.5	93.1
Test 2	87.4	89.0	84.3	86.7	87.7	87.9	88.5	91.0	91.0	92.3	93.7	94.3	94.7
Test 3	84.9	88.5	84.4	87.1	87.9	91.2	88.7	90.5	90.7	92.0	93.8	95.7	95.5
Mean	86.3	88.5	84.2	86.8	87.6	88.8	88.9	91.3	90.8	92.0	93.4	94.8	94.4
Error													
Occluded													
Test 1	86.1	89.9	87.0	91.4	94.6	96.4	94.0	89.1	80.6	80.4	76.8	72.7	68.7
Test 2	86.1	90.0	87.0	91.3	94.8	96.5	94.1	89.3	80.7	80.7	75.0	73.2	70.1
Test 3	86.2	90.1	87.1	91.3	94.6	96.5	94.1	89.5	81.2	80.4	75.4	74.2	70.9
Mean	86.1	90.0	87.0	91.3	94.7	96.5	94.0	89.3	80.8	80.5	75.7	73.3	69.9
Right Insertion Loss	**0.2**	**-1.5**	**-2.8**	**-4.5**	**-7.1**	**-7.7**	**-5.1**	**2.0**	**10.0**	**11.5**	**17.7**	**21.5**	**24.5**
Insertion Loss	**0.6**	**-1.1**	**-2.6**	**-4.0**	**-5.4**	**-7.1**	**-7.1**	**-2.4**	**5.5**	**7.5**	**13.6**	**17.1**	**21.1**

Table J-4. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 6.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.7	93.9	97.2	97.7	98.4	100.3	98.8	96.8	92.2	92.3	90.1	79.7	108	109
Test 2	92.5	95.0	97.7	98.3	97.6	99.3	97.6	96.4	92.6	92.9	90.7	80.5	108	108
Test 3	92.3	95.5	97.8	98.0	97.3	100.1	98.6	96.5	93.1	92.5	90.7	80.8	108	108
Mean	92.5	94.8	97.6	98.0	97.7	99.9	98.3	96.6	92.6	92.6	90.5	80.3	108	108
Occluded														
Test 1	68.7	69.5	70.1	65.3	61.3	64.1	66.6	63.6	58.6	55.2	50.0	49.0	104	96
Test 2	70.7	69.5	70.9	66.8	60.9	64.7	65.8	63.1	58.4	54.8	50.1	47.8	103	96
Test 3	69.4	67.7	70.3	64.4	59.8	63.5	64.6	63.0	58.6	53.2	48.1	46.6	103	95
Mean	69.6	68.9	70.4	65.5	60.7	64.1	65.6	63.2	58.5	54.4	49.4	47.8	103	96
Left Insertion Loss	**22.9**	**25.9**	**27.2**	**32.5**	**37.1**	**35.8**	**32.7**	**33.3**	**34.1**	**38.1**	**41.1**	**32.5**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	90.8	93.8	96.2	98.4	98.9	100.7	98.9	96.6	93.1	92.1	89.9	80.5	108	109
Test 2	90.1	94.9	94.9	97.9	98.3	99.6	96.8	94.3	93.6	91.8	89.1	80.3	108	108
Test 3	90.1	93.4	95.0	97.6	98.0	100.1	97.1	93.9	92.9	91.9	89.8	81.2	108	108
Mean	90.3	94.0	95.4	98.0	98.4	100.1	97.6	94.9	93.2	91.9	89.6	80.7	108	
Occluded														
Test 1	60.7	60.6	65.6	61.7	59.5	60.4	59.8	62.2	58.7	57.4	56.0	57.9	102	91
Test 2	60.6	60.5	65.8	60.7	59.1	58.5	58.4	60.3	54.7	55.5	55.4	57.2	102	91
Test 3	61.0	60.9	66.6	61.5	59.0	58.1	58.1	58.3	54.6	55.4	56.0	57.2	102	91
Mean	60.8	60.7	66.0	61.3	59.2	59.0	58.8	60.3	56.0	56.1	55.8	57.4	102	91
Right Insertion Loss	**29.6**	**33.4**	**29.4**	**36.7**	**39.2**	**41.1**	**38.8**	**34.6**	**37.2**	**35.8**	**33.8**	**23.3**		
Insertion Loss	**26.2**	**29.6**	**28.3**	**34.6**	**38.1**	**38.5**	**35.8**	**34.0**	**35.7**	**37.0**	**37.5**	**27.9**		

Table J-5. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 7.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.4	88.5	83.2	85.5	88.9	87.4	88.1	91.3	90.2	91.7	92.7	91.8	93.9
Test 2	87.5	88.7	83.4	86.0	88.8	87.7	87.8	91.0	89.7	91.2	92.6	92.3	93.9
Test 3	87.4	88.3	83.4	86.0	88.6	89.4	86.9	92.2	90.5	92.2	94.5	92.7	93.0
Mean	87.4	88.5	83.3	85.8	88.8	88.2	87.6	91.5	90.1	91.7	93.3	92.3	93.6
Occluded													
Test 1	79.6	58.1	59.3	73.8	56.7	58.3	57.8	52.7	56.8	52.2	52.6	53.7	48.6
Test 2	88.4	89.7	85.3	88.4	89.6	87.3	85.3	82.0	74.6	75.2	76.1	73.5	67.2
Test 3	85.9	88.2	83.8	85.9	85.8	86.3	80.6	78.1	72.8	73.8	72.7	73.0	70.2
Mean	84.6	78.7	76.1	82.7	77.3	77.3	74.6	71.0	68.1	67.1	67.1	66.7	62.0
Left Insertion Loss	**2.8**	**9.8**	**7.2**	**3.1**	**11.4**	**10.9**	**13.0**	**20.5**	**22.1**	**24.6**	**26.1**	**25.6**	**31.6**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.9	88.6	84.3	86.5	87.3	88.3	88.2	92.1	92.0	92.1	93.4	93.6	93.1
Test 2	87.2	89.0	84.4	86.7	87.5	88.4	87.8	91.1	91.6	92.1	94.4	94.2	94.1
Test 3	87.0	88.5	84.2	86.4	87.4	87.1	87.7	91.0	92.0	92.3	94.5	93.9	93.5
Mean	87.0	88.7	84.3	86.5	87.4	87.9	87.9	91.4	91.9	92.2	94.1	93.9	93.6
Error													
Occluded													
Test 1	79.2	57.5	58.9	73.4	55.4	55.7	57.5	52.9	56.3	52.0	52.1	53.4	48.2
Test 2	79.0	80.1	77.4	79.2	78.5	76.8	76.0	77.3	74.8	76.4	72.7	68.4	64.6
Test 3	75.1	79.0	76.7	78.6	77.6	79.8	75.8	76.5	73.7	75.4	71.6	68.4	65.6
Mean	77.8	72.2	71.0	77.1	70.5	70.8	69.8	68.9	68.3	67.9	65.5	63.4	59.5
Right Insertion Loss	**9.2**	**16.5**	**13.3**	**9.5**	**16.9**	**17.2**	**18.1**	**22.5**	**23.6**	**24.2**	**28.6**	**30.4**	**34.1**
Insertion Loss	**6.0**	**13.2**	**10.2**	**6.3**	**14.2**	**14.0**	**15.6**	**21.5**	**22.8**	**24.4**	**27.4**	**28.0**	**32.9**

Table J-5. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 7.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.2	94.3	96.6	98.5	97.9	100.6	99.7	99.3	95.9	93.8	87.9	81.0	109	109
Test 2	92.4	94.8	97.1	98.0	97.4	99.7	98.5	98.8	96.4	95.0	88.6	81.6	108	109
Test 3	91.7	94.9	95.5	99.1	98.3	99.9	99.2	98.0	95.6	96.0	89.0	81.9	109	109
Mean	92.1	94.7	96.4	98.5	97.9	100.1	99.1	98.7	96.0	94.9	88.5	81.5	108	109
Occluded														
Test 1	47.4	48.2	46.1	47.0	47.5	49.1	50.8	51.3	53.4	56.4	59.2	61.7	81	65
Test 2	63.6	70.6	71.3	66.0	54.8	52.2	49.8	49.0	44.9	45.6	46.2	47.9	97	85
Test 3	63.0	70.7	71.5	65.1	55.6	51.4	50.3	46.2	43.3	44.2	46.2	48.6	94	83
Mean	58.0	63.2	63.0	59.4	52.6	50.9	50.3	48.8	47.2	48.7	50.5	52.7	91	78
Left Insertion Loss	**34.1**	**31.5**	**33.5**	**39.2**	**45.2**	**49.1**	**48.8**	**49.9**	**48.8**	**46.2**	**38.0**	**28.8**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.0	92.7	95.0	96.6	97.8	99.9	97.5	96.6	95.6	93.8	87.0	78.8	108	108
Test 2	91.4	92.5	94.8	96.6	96.7	99.1	98.2	95.8	96.1	93.6	86.3	78.5	108	108
Test 3	91.1	92.5	94.1	96.1	97.4	99.9	96.6	95.9	95.8	93.7	86.4	79.3	107	108
Mean	91.5	92.6	94.6	96.4	97.3	99.6	97.4	96.1	95.8	93.7	86.6	78.9	108	
Occluded														
Test 1	46.8	47.8	46.0	47.0	47.6	49.4	50.8	52.2	54.8	57.8	60.6	63.0	81	65
Test 2	61.2	65.9	65.6	62.2	54.9	51.0	49.0	48.4	48.8	51.7	54.4	56.9	88	79
Test 3	61.5	66.3	63.9	60.9	54.5	51.4	49.8	47.9	49.4	51.9	54.6	57.1	87	79
Mean	56.5	60.0	58.5	56.7	52.4	50.6	49.9	49.5	51.0	53.8	56.5	59.0	85	75
Right Insertion Loss	**35.0**	**32.5**	**36.1**	**39.7**	**45.0**	**49.1**	**47.6**	**46.6**	**44.8**	**39.9**	**30.1**	**19.8**		
Insertion Loss	**34.6**	**32.0**	**34.8**	**39.4**	**45.1**	**49.1**	**48.2**	**48.2**	**46.8**	**43.0**	**34.0**	**24.3**		

Table J-6. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 8.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.4	88.3	83.2	85.8	88.5	88.6	88.4	92.4	90.4	91.1	93.2	92.3	92.1
Test 2	85.6	88.7	83.7	86.5	88.9	88.9	89.1	91.0	88.5	89.7	93.5	93.2	93.7
Test 3	87.9	89.0	83.0	85.6	89.1	87.4	89.5	91.7	90.2	90.8	92.3	91.8	93.4
Mean	87.0	88.7	83.3	86.0	88.9	88.3	89.0	91.7	89.7	90.6	93.0	92.4	93.1
Occluded													
Test 1	88.9	90.6	86.1	89.8	93.3	91.4	96.7	93.8	86.5	85.1	80.0	79.2	73.3
Test 2	88.8	90.4	86.1	89.5	93.7	92.2	96.6	93.4	86.5	86.4	81.0	79.6	73.8
Test 3	88.7	90.2	85.9	89.3	93.1	91.7	96.8	93.8	88.1	87.7	81.4	79.8	73.7
Mean	88.8	90.4	86.0	89.5	93.4	91.8	96.7	93.7	87.0	86.4	80.8	79.5	73.6
Left Insertion Loss	**-1.8**	**-1.7**	**-2.7**	**-3.6**	**-4.5**	**-3.5**	**-7.7**	**-2.0**	**2.7**	**4.2**	**12.1**	**12.9**	**19.4**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.1	88.7	84.3	86.6	87.3	88.1	88.7	89.2	91.1	91.5	94.8	93.1	93.2
Test 2	85.0	88.7	84.6	87.2	87.8	91.6	88.3	89.9	88.9	91.4	94.5	94.0	94.8
Test 3	87.3	89.1	84.5	86.8	87.4	88.6	88.7	90.1	89.9	91.8	94.0	93.1	93.5
Mean	86.5	88.8	84.5	86.9	87.5	89.4	88.6	89.7	90.0	91.6	94.4	93.4	93.9
Error													
Occluded													
Test 1	90.0	92.4	89.0	92.3	93.0	87.8	84.8	80.7	76.1	73.3	73.3	71.5	70.1
Test 2	89.5	91.6	88.4	92.2	95.2	92.4	89.0	84.8	78.9	75.3	75.3	72.5	69.2
Test 3	88.9	91.0	87.9	91.9	94.5	91.6	90.4	85.4	79.5	75.5	75.3	71.7	69.9
Mean	89.5	91.7	88.4	92.1	94.2	90.6	88.0	83.6	78.2	74.7	74.6	71.9	69.7
Right Insertion Loss	**-3.0**	**-2.8**	**-4.0**	**-5.3**	**-6.7**	**-1.2**	**0.5**	**6.1**	**11.8**	**16.8**	**19.8**	**21.5**	**24.2**
Insertion Loss	**-2.4**	**-2.3**	**-3.3**	**-4.4**	**-5.6**	**-2.3**	**-3.6**	**2.1**	**7.2**	**10.5**	**16.0**	**17.2**	**21.8**

Table J-6. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 8.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.1	93.8	96.9	98.9	98.8	101.8	100.0	97.6	94.6	91.4	90.3	80.7	109	109
Test 2	93.3	94.9	98.2	98.7	99.8	101.5	98.8	97.2	94.6	92.1	90.2	80.2	109	109
Test 3	92.7	95.2	98.1	98.4	99.3	101.7	99.1	98.0	94.9	92.4	91.1	81.2	109	109
Mean	92.4	94.6	97.7	98.7	99.3	101.7	99.3	97.6	94.7	91.9	90.5	80.7	109	109
Occluded														
Test 1	70.6	70.0	68.5	67.0	59.4	67.2	65.6	62.3	64.3	54.8	54.4	50.7	102	93
Test 2	69.7	69.3	71.1	67.0	60.1	68.5	66.3	61.6	60.8	53.5	53.5	50.6	102	93
Test 3	69.7	69.5	71.7	68.6	60.9	68.1	68.2	63.6	62.0	56.9	55.3	51.2	102	93
Mean	70.0	69.6	70.4	67.5	60.1	67.9	66.7	62.5	62.4	55.1	54.4	50.8	102	93
Left Insertion Loss	**22.3**	**25.0**	**27.3**	**31.2**	**39.2**	**33.8**	**32.6**	**35.1**	**32.3**	**36.9**	**36.1**	**29.8**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	93.1	94.2	96.4	98.1	100.7	101.8	99.8	95.7	90.2	88.0	88.5	79.1	109	109
Test 2	92.4	94.7	96.7	98.2	99.9	100.8	99.9	95.9	91.2	88.4	88.4	78.9	108	109
Test 3	92.4	94.7	95.3	98.6	99.1	101.7	99.3	96.3	90.9	88.1	87.9	78.9	108	109
Mean	92.6	94.5	96.1	98.3	99.9	101.4	99.7	96.0	90.8	88.2	88.3	79.0	108	
Occluded														
Test 1	64.0	63.7	63.9	59.2	53.6	56.9	56.4	55.3	56.0	53.1	55.2	57.7	99	85
Test 2	63.8	61.5	63.8	60.8	58.5	58.2	55.9	57.6	57.5	54.0	55.2	57.6	100	88
Test 3	63.5	62.4	62.9	62.6	57.7	56.9	57.1	57.1	56.4	52.9	55.4	57.9	100	88
Mean	63.8	62.5	63.5	60.9	56.6	57.4	56.5	56.7	56.6	53.3	55.2	57.7	100	87
Right Insertion Loss	**28.9**	**32.0**	**32.6**	**37.4**	**43.3**	**44.1**	**43.2**	**39.3**	**34.2**	**34.8**	**33.0**	**21.3**		
Insertion Loss	**25.6**	**28.5**	**29.9**	**34.3**	**41.2**	**38.9**	**37.9**	**37.2**	**33.2**	**35.9**	**34.6**	**25.5**		

Table J-7. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 9.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.6	88.1	82.7	85.7	88.9	89.4	89.0	91.2	88.7	92.6	94.3	92.8	92.6
Test 2	85.5	88.2	83.0	86.1	88.9	89.4	88.7	90.7	89.5	92.9	94.7	92.6	92.5
Test 3	87.8	88.5	82.6	84.9	89.2	88.1	89.8	91.3	91.0	93.2	94.4	91.7	92.8
Mean	86.3	88.3	82.8	85.6	89.0	89.0	89.2	91.1	89.8	92.9	94.5	92.4	92.7
Occluded													
Test 1	88.6	89.8	86.0	89.9	94.1	93.1	92.3	87.7	80.3	79.6	76.8	74.5	72.2
Test 2	85.9	88.8	84.9	88.6	91.9	93.3	97.5	97.7	92.0	90.6	87.2	82.6	77.3
Test 3	88.0	88.9	84.7	87.8	91.9	91.9	98.9	98.1	93.2	90.6	85.6	80.9	77.0
Mean	87.5	89.2	85.2	88.8	92.6	92.8	96.2	94.5	88.5	86.9	83.2	79.3	75.5
Left Insertion Loss	**-1.2**	**-0.9**	**-2.5**	**-3.2**	**-3.7**	**-3.8**	**-7.0**	**-3.4**	**1.2**	**6.0**	**11.3**	**13.0**	**17.2**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.0	88.3	84.0	86.6	87.8	89.2	87.2	89.4	88.5	89.7	91.9	94.8	94.8
Test 2	84.9	88.3	84.0	86.6	87.7	89.5	87.1	89.0	89.5	89.8	92.8	94.8	95.1
Test 3	86.9	88.2	83.9	86.0	87.1	86.5	88.7	90.5	91.4	90.6	94.6	94.0	94.0
Mean	85.6	88.3	84.0	86.4	87.5	88.4	87.7	89.7	89.8	90.0	93.1	94.5	94.6
Error													
Occluded													
Test 1	88.6	90.3	85.9	87.9	86.5	83.8	85.5	85.6	78.6	74.9	73.9	74.6	71.0
Test 2	86.0	89.0	85.6	88.9	92.4	94.6	97.1	93.9	84.6	80.1	81.3	80.7	77.7
Test 3	87.6	88.8	84.9	87.3	91.1	90.8	96.4	94.3	86.7	82.8	84.6	78.9	78.1
Mean	87.4	89.4	85.5	88.0	90.0	89.7	93.0	91.3	83.3	79.2	80.0	78.1	75.6
Right Insertion Loss	**-1.8**	**-1.1**	**-1.5**	**-1.6**	**-2.5**	**-1.3**	**-5.3**	**-1.6**	**6.5**	**10.8**	**13.1**	**16.4**	**19.0**
Insertion Loss	**-1.5**	**-1.0**	**-2.0**	**-2.4**	**-3.1**	**-2.6**	**-6.2**	**-2.5**	**3.9**	**8.4**	**12.2**	**14.7**	**18.1**

Table J-7. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 9.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	91.1	93.5	96.0	99.5	99.6	102.3	101.4	98.7	90.7	86.0	89.1	82.0	109	110
Test 2	91.6	93.9	95.4	99.5	98.7	102.0	101.9	98.6	91.1	86.7	89.3	81.2	109	109
Test 3	93.0	93.4	96.0	99.2	98.5	102.2	100.8	99.1	90.8	87.2	88.5	80.7	109	109
Mean	91.9	93.6	95.8	99.4	98.9	102.1	101.4	98.8	90.9	86.6	88.9	81.3	109	110
Occluded														
Test 1	65.9	73.7	74.5	70.9	62.7	65.6	65.3	58.3	47.3	49.7	57.0	50.7	100	90
Test 2	73.6	73.6	74.4	75.0	71.9	79.2	80.9	74.6	59.2	60.0	61.4	52.9	103	97
Test 3	74.9	73.8	74.4	74.7	69.7	77.7	79.7	71.3	56.0	59.2	59.8	53.1	104	97
Mean	71.4	73.7	74.4	73.5	68.1	74.2	75.3	68.1	54.2	56.3	59.4	52.2	102	94
Left Insertion Loss	**20.5**	**19.9**	**21.4**	**25.9**	**30.8**	**28.0**	**26.1**	**30.7**	**36.7**	**30.3**	**29.5**	**29.1**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.6	93.0	96.6	98.7	98.9	102.0	100.1	95.9	90.4	89.0	87.6	81.7	108	109
Test 2	91.2	92.7	97.5	98.9	99.1	101.1	99.4	96.2	91.9	90.8	88.2	80.9	108	109
Test 3	90.2	93.8	95.6	97.4	97.7	101.3	97.9	95.0	92.7	92.2	88.7	81.0	108	108
Mean	91.0	93.2	96.6	98.3	98.6	101.5	99.1	95.7	91.7	90.6	88.2	81.2	108	
Occluded														
Test 1	68.5	73.9	70.5	65.4	68.3	67.6	64.8	65.8	61.0	59.3	55.8	54.8	96	86
Test 2	68.7	67.9	72.2	74.8	76.2	72.3	73.2	71.1	64.0	62.2	60.4	56.1	102	94
Test 3	75.6	78.1	79.8	82.6	79.5	71.7	76.2	72.0	69.3	67.5	66.4	58.2	101	94
Mean	71.0	73.3	74.2	74.3	74.7	70.6	71.4	69.6	64.8	63.0	60.9	56.4	100	91
Right Insertion Loss	**20.0**	**19.9**	**22.4**	**24.1**	**23.9**	**30.9**	**27.7**	**26.1**	**26.9**	**27.7**	**27.3**	**24.8**		
Insertion Loss	**20.3**	**19.9**	**21.9**	**25.0**	**27.4**	**29.5**	**26.9**	**28.4**	**31.8**	**29.0**	**28.4**	**26.9**		

Table J-8. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 10.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.4	88.5	84.4	87.3	88.9	91.9	87.4	91.9	90.9	92.2	93.3	94.8	95.4
Test 2	85.9	89.1	84.6	87.5	89.5	90.9	88.2	90.9	89.1	92.2	94.2	93.2	94.4
Test 3	85.7	88.9	84.4	87.1	89.2	90.7	88.3	91.0	89.4	92.9	95.1	92.8	94.3
Mean	85.7	88.8	84.5	87.3	89.2	91.2	88.0	91.3	89.8	92.4	94.2	93.6	94.7
Occluded													
Test 1	88.5	89.9	85.6	89.0	93.0	93.3	98.1	96.1	87.6	86.5	82.5	79.6	73.8
Test 2	86.1	89.7	86.2	90.0	93.1	96.4	97.9	97.0	88.7	86.2	83.0	80.6	74.1
Test 3	86.1	89.6	86.1	89.8	92.6	95.9	97.7	97.9	90.1	87.7	84.5	81.8	75.5
Mean	86.9	89.7	86.0	89.6	92.9	95.2	97.9	97.0	88.8	86.8	83.3	80.7	74.5
Left Insertion Loss	**-1.2**	**-0.9**	**-1.5**	**-2.3**	**-3.7**	**-4.0**	**-9.9**	**-5.8**	**1.0**	**5.7**	**10.8**	**13.0**	**20.2**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.0	88.7	84.7	87.2	87.9	90.9	87.1	89.7	89.3	90.1	92.7	93.9	93.5
Test 2	85.2	88.8	84.7	87.4	88.1	91.7	87.1	91.4	90.3	91.3	93.0	94.5	94.2
Test 3	84.9	88.7	84.9	87.5	87.8	91.9	87.4	91.8	89.9	91.1	92.9	94.0	93.7
Mean	85.0	88.7	84.8	87.4	88.0	91.5	87.2	90.9	89.8	90.8	92.9	94.2	93.8
Error													
Occluded													
Test 1	88.4	90.2	86.0	89.1	92.2	91.0	95.2	95.9	89.4	83.3	81.6	80.0	75.8
Test 2	86.2	90.0	86.4	90.0	92.6	95.5	94.8	95.0	88.1	82.5	80.7	81.7	76.1
Test 3	85.8	89.7	86.4	90.0	92.4	96.0	96.3	96.2	89.4	83.6	82.2	82.0	75.4
Mean	86.8	90.0	86.3	89.7	92.4	94.2	95.4	95.7	89.0	83.1	81.5	81.2	75.8
Right Insertion Loss	**-1.8**	**-1.2**	**-1.5**	**-2.3**	**-4.4**	**-2.7**	**-8.2**	**-4.8**	**0.9**	**7.7**	**11.3**	**12.9**	**18.0**
Insertion Loss	**-1.5**	**-1.1**	**-1.5**	**-2.3**	**-4.1**	**-3.3**	**-9.1**	**-5.3**	**0.9**	**6.7**	**11.1**	**12.9**	**19.1**

Table J-8. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 10.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	91.5	95.7	96.3	98.6	99.5	101.7	98.9	95.8	95.8	93.8	85.9	78.1	109	109
Test 2	92.5	93.8	96.5	98.9	97.9	100.5	97.3	95.4	97.9	93.6	88.2	78.7	108	108
Test 3	92.1	94.2	97.0	98.0	98.1	100.8	96.5	95.2	97.7	92.8	88.4	79.2	108	108
Mean	92.0	94.6	96.6	98.5	98.5	101.0	97.6	95.5	97.1	93.4	87.5	78.7	108	109
Occluded														
Test 1	69.0	73.0	75.4	73.6	66.8	71.1	70.8	67.1	62.9	60.6	56.5	52.8	103	95
Test 2	67.6	72.9	73.4	73.7	67.3	72.2	71.9	67.5	63.5	62.9	57.9	52.8	103	95
Test 3	69.0	73.1	74.0	75.2	69.2	73.4	71.7	66.8	62.7	64.0	57.3	50.2	104	96
Mean	68.5	73.0	74.3	74.2	67.8	72.2	71.5	67.2	63.0	62.5	57.2	51.9	103	95
Left Insertion Loss	**23.5**	**21.6**	**22.3**	**24.3**	**30.7**	**28.8**	**26.1**	**28.3**	**34.1**	**30.9**	**30.3**	**26.7**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.3	93.8	95.8	97.6	99.5	102.2	99.7	96.5	94.3	90.2	85.3	78.3	108	109
Test 2	91.3	93.4	95.1	97.3	99.3	102.1	99.1	96.1	94.4	91.5	85.3	80.5	108	109
Test 3	91.4	92.8	94.7	97.9	99.8	102.1	99.1	96.7	95.3	89.6	85.5	80.8	109	109
Mean	91.4	93.3	95.2	97.6	99.5	102.1	99.3	96.4	94.7	90.4	85.3	79.9	108	
Occluded														
Test 1	69.0	66.2	66.6	68.4	65.9	68.7	64.1	55.2	54.2	56.5	56.4	56.0	102	93
Test 2	67.7	66.7	66.9	68.3	68.3	70.4	65.7	58.1	55.8	56.1	55.0	55.6	102	93
Test 3	66.5	66.7	67.3	67.0	66.6	69.5	65.2	57.8	56.8	58.8	55.0	54.4	103	94
Mean	67.7	66.5	66.9	67.9	66.9	69.5	65.0	57.0	55.6	57.1	55.5	55.4	102	93
Right Insertion Loss	**23.6**	**26.8**	**28.3**	**29.7**	**32.6**	**32.6**	**34.3**	**39.4**	**39.1**	**33.3**	**29.9**	**24.5**		
Insertion Loss	**23.6**	**24.2**	**25.3**	**27.0**	**31.7**	**30.7**	**30.2**	**33.9**	**36.6**	**32.1**	**30.1**	**25.6**		

Table J-9. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 11.

Left	63	80	100	125	160	200	250	315	400	500	630	800	1000
Unoccluded													
Test 1	80.7	83.9	79.2	82.1	84.3	84.6	83.4	85.7	84.4	88.0	90.0	87.3	89.2
Test 2	81.0	84.3	79.4	82.5	84.2	84.7	84.0	85.1	83.6	86.6	89.3	87.3	89.3
Test 3	81.1	84.3	79.4	82.3	84.5	84.3	84.2	85.2	83.6	87.1	90.0	87.1	88.7
Mean	81.0	84.2	79.4	82.3	84.4	84.5	83.9	85.3	83.9	87.2	89.8	87.2	89.1
Occluded													
Test 1	81.8	85.3	81.6	85.6	88.8	90.1	91.9	89.8	82.3	80.7	81.2	76.4	72.5
Test 2	81.9	85.6	81.7	85.8	88.9	90.6	91.9	89.7	82.5	80.4	79.4	75.5	72.1
Test 3	81.6	85.2	81.6	85.6	88.5	90.6	91.9	90.5	83.8	81.2	80.1	76.5	72.1
Mean	81.8	85.4	81.6	85.7	88.7	90.4	91.9	90.0	82.8	80.8	80.3	76.1	72.2
Left Insertion Loss	**-0.8**	**-1.2**	**-2.3**	**-3.4**	**-4.4**	**-5.9**	**-8.0**	**-4.7**	**1.0**	**6.4**	**9.5**	**11.1**	**16.8**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	80.7	84.4	80.5	83.3	83.7	87.5	83.4	88.3	86.3	87.0	89.0	90.1	89.5
Test 2	80.9	84.7	80.4	83.2	83.6	87.4	83.7	88.5	86.1	87.1	89.3	89.7	89.9
Test 3	81.2	84.9	80.6	83.2	83.7	86.9	83.2	88.0	85.9	86.5	89.0	89.4	90.0
Mean	80.9	84.7	80.5	83.3	83.7	87.3	83.4	88.3	86.1	86.9	89.1	89.7	89.8
Error													
Occluded													
Test 1	82.5	86.3	83.0	87.3	90.0	92.1	87.4	83.8	76.1	73.9	74.3	72.8	68.3
Test 2	82.6	86.5	83.1	87.2	89.6	91.6	87.2	83.9	76.3	74.9	74.1	73.6	70.6
Test 3	82.3	86.1	82.8	86.9	89.6	92.2	90.3	88.0	80.4	77.2	76.3	75.6	72.7
Mean	82.5	86.3	83.0	87.1	89.7	91.9	88.3	85.3	77.6	75.3	74.9	74.0	70.6
Right Insertion Loss	**-1.5**	**-1.6**	**-2.4**	**-3.9**	**-6.1**	**-4.7**	**-4.9**	**3.0**	**8.5**	**11.5**	**14.2**	**15.8**	**19.2**
Insertion Loss	**-1.2**	**-1.4**	**-2.3**	**-3.6**	**-5.2**	**-5.3**	**-6.5**	**-0.8**	**4.8**	**9.0**	**11.8**	**13.4**	**18.0**

Table J-9. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 11.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	88.0	90.2	93.0	93.6	95.9	97.9	92.6	90.9	88.2	88.4	86.7	77.2	104	105
Test 2	87.7	89.9	92.9	94.6	95.6	97.4	92.7	90.8	88.9	87.5	86.4	77.5	104	104
Test 3	87.6	89.6	92.6	93.6	95.2	97.0	89.8	90.2	90.7	89.7	87.4	77.8	104	104
Mean	87.8	89.9	92.8	93.9	95.6	97.4	91.7	90.6	89.3	88.6	86.8	77.5	104	104
Occluded														
Test 1	67.3	65.3	69.0	66.1	60.7	58.6	53.5	47.8	47.9	49.6	46.1	43.5	98	89
Test 2	69.8	66.3	68.7	64.3	61.6	60.8	55.4	51.6	51.1	48.6	47.1	44.1	98	89
Test 3	68.4	65.0	69.0	64.8	60.9	61.9	56.1	50.8	48.2	51.1	46.5	44.6	98	89
Mean	68.5	65.5	68.9	65.0	61.1	60.4	55.0	50.1	49.0	49.8	46.6	44.1	98	89
Left Insertion Loss	**19.2**	**24.4**	**23.9**	**28.9**	**34.5**	**37.0**	**36.7**	**40.5**	**40.2**	**38.8**	**40.2**	**33.4**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	86.8	89.6	91.4	93.6	96.3	97.7	94.7	94.7	90.2	85.9	84.4	78.4	105	105
Test 2	88.1	89.0	90.8	93.2	95.8	96.9	95.1	94.9	90.5	86.1	84.4	77.9	104	105
Test 3	87.6	89.9	91.5	93.6	95.7	97.3	95.3	94.3	90.4	85.1	83.7	77.8	104	105
Mean	87.5	89.5	91.3	93.5	95.9	97.3	95.0	94.6	90.4	85.7	84.2	78.0	105	
Occluded														
Test 1	59.2	60.9	64.2	60.5	52.5	53.3	54.7	51.0	47.1	42.7	44.5	45.3	97	85
Test 2	60.2	61.1	64.5	61.9	56.8	60.5	58.9	49.8	48.5	44.0	44.1	45.4	97	85
Test 3	62.5	62.6	65.3	62.9	57.9	60.1	60.2	49.6	42.9	45.2	46.4	46.2	98	87
Mean	60.6	61.6	64.7	61.8	55.7	58.0	57.9	50.1	46.2	43.9	45.0	45.7	97	86
Right Insertion Loss	**26.8**	**28.0**	**26.6**	**31.7**	**40.2**	**39.3**	**37.1**	**44.5**	**44.2**	**41.8**	**39.2**	**32.4**		
Insertion Loss	**23.0**	**26.2**	**25.2**	**30.3**	**37.4**	**38.2**	**36.9**	**42.5**	**42.2**	**40.3**	**39.7**	**32.9**		

Table J-10. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 12.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	84.8	87.6	83.2	86.5	88.1	90.0	88.1	91.5	90.6	92.0	93.4	93.8	93.8
Test 2	85.3	87.9	83.2	86.7	88.5	90.2	88.0	91.5	90.8	92.9	93.5	93.7	94.1
Test 3	85.1	87.7	83.3	86.6	88.4	90.3	88.0	91.8	91.3	92.9	93.6	94.1	94.7
Mean	85.1	87.7	83.2	86.6	88.3	90.2	88.0	91.6	90.9	92.6	93.5	93.9	94.2
Occluded													
Test 1	85.6	88.2	84.4	87.9	89.4	90.5	89.4	88.0	82.8	79.6	79.5	75.5	72.5
Test 2	85.3	87.9	84.1	87.2	88.2	89.4	87.9	85.7	80.4	78.5	77.9	73.5	70.8
Test 3	85.3	88.0	84.4	87.8	89.2	90.9	89.5	87.8	82.7	80.1	81.1	78.4	76.7
Mean	85.4	88.0	84.3	87.7	88.9	90.3	89.0	87.2	82.0	79.4	79.5	75.8	73.3
Left Insertion Loss	**-0.3**	**-0.3**	**-1.1**	**-1.1**	**-0.6**	**-0.1**	**-0.9**	**4.4**	**9.0**	**13.2**	**14.0**	**18.0**	**20.8**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	84.4	87.9	83.8	86.3	87.6	90.1	87.8	91.2	90.7	91.4	94.4	94.2	94.3
Test 2	84.5	87.9	83.6	86.2	87.6	89.9	87.9	91.5	90.8	90.6	94.1	93.5	94.0
Test 3	84.4	87.8	83.8	86.2	87.6	89.9	87.6	91.3	90.7	90.3	94.2	93.2	94.1
Mean	84.5	87.9	83.7	86.2	87.6	90.0	87.8	91.3	90.8	90.8	94.2	93.6	94.1
Error													
Occluded													
Test 1	83.3	85.6	81.3	84.1	85.1	86.2	84.3	82.7	80.6	80.7	77.4	73.8	71.2
Test 2	80.9	83.0	79.1	81.7	82.4	83.3	80.3	79.9	77.6	78.3	75.4	71.6	68.8
Test 3	82.1	84.3	80.6	83.0	83.4	84.8	82.2	81.8	79.0	79.4	76.3	73.1	69.4
Mean	82.1	84.3	80.3	82.9	83.6	84.8	82.3	81.5	79.1	79.5	76.3	72.8	69.8
Right Insertion Loss	**2.4**	**3.5**	**3.4**	**3.3**	**4.0**	**5.2**	**5.5**	**9.8**	**11.7**	**11.3**	**17.9**	**20.8**	**24.3**
Insertion Loss	**1.0**	**1.6**	**1.2**	**1.1**	**1.7**	**2.5**	**2.3**	**7.1**	**10.3**	**12.3**	**15.9**	**19.4**	**22.6**

Table J-10. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 12.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	90.8	94.6	96.8	97.3	97.2	99.4	97.2	94.9	92.8	92.8	88.9	80.9	107	108
Test 2	91.3	94.6	97.0	97.0	96.7	98.8	96.8	94.1	92.9	93.4	89.8	80.8	107	108
Test 3	90.8	94.7	97.1	96.7	96.9	98.6	96.6	94.3	93.3	93.2	89.6	81.5	107	107
Mean	91.0	94.6	97.0	97.0	96.9	98.9	96.9	94.5	93.0	93.1	89.5	81.1	107	108
Occluded														
Test 1	64.8	68.8	68.9	68.5	65.4	64.3	62.6	57.8	57.4	57.7	53.0	47.9	98	89
Test 2	65.6	70.1	69.3	66.6	61.0	59.5	56.7	55.2	53.8	51.7	47.9	46.7	97	87
Test 3	68.1	67.8	70.3	70.9	68.0	69.9	68.1	67.3	68.2	64.6	57.6	50.6	98	89
Mean	66.2	68.9	69.5	68.7	64.8	64.6	62.5	60.1	59.8	58.0	52.8	48.4	97	88
Left Insertion Loss	**24.8**	**25.7**	**27.5**	**28.3**	**32.1**	**34.3**	**34.4**	**34.4**	**33.2**	**35.1**	**36.6**	**32.7**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	93.4	94.8	96.6	98.2	99.2	99.2	99.9	98.4	94.9	92.8	86.8	75.6	109	109
Test 2	92.7	94.3	96.0	98.0	98.6	98.8	98.8	97.9	94.8	92.5	85.7	76.5	108	108
Test 3	92.3	93.6	95.9	97.3	97.7	97.8	99.2	97.9	94.3	91.0	87.2	77.4	108	108
Mean	92.8	94.2	96.1	97.9	98.5	98.6	99.3	98.1	94.7	92.1	86.6	76.5	108	
Occluded														
Test 1	63.7	69.3	71.2	70.2	71.0	71.8	72.5	71.9	69.3	66.9	62.5	55.6	94	86
Test 2	61.9	67.0	67.2	64.4	61.0	61.8	59.4	59.1	56.4	55.4	51.3	52.5	91	82
Test 3	65.0	67.9	66.1	62.5	63.3	64.2	63.1	60.4	59.5	53.9	55.2	54.3	93	84
Mean	63.5	68.1	68.2	65.7	65.1	65.9	65.0	63.8	61.7	58.7	56.3	54.1	93	84
Right Insertion Loss	**29.3**	**26.2**	**28.0**	**32.1**	**33.4**	**32.7**	**34.3**	**34.3**	**32.9**	**33.4**	**30.3**	**22.4**		
Insertion Loss	**27.0**	**26.0**	**27.7**	**30.2**	**32.8**	**33.5**	**34.4**	**34.3**	**33.1**	**34.3**	**33.4**	**27.5**		

Table J-11. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 13.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.9	87.5	82.3	84.6	88.0	88.0	88.5	91.6	90.6	92.4	93.9	91.4	92.8
Test 2	84.9	87.7	82.8	85.6	88.1	89.1	88.4	90.9	89.0	91.5	94.1	91.7	93.8
Test 3	86.9	87.6	82.4	84.7	88.0	88.1	88.7	91.8	90.5	92.3	93.6	91.2	92.9
Mean	86.2	87.6	82.5	84.9	88.0	88.4	88.5	91.4	90.0	92.0	93.9	91.4	93.2
Occluded													
Test 1	85.9	89.3	85.4	89.0	92.8	94.8	97.3	93.5	83.2	83.8	84.8	80.0	76.2
Test 2	85.7	88.9	85.5	89.1	92.4	94.9	96.7	92.0	82.0	82.1	84.6	80.2	76.2
Test 3	85.6	88.8	85.7	89.4	92.9	95.4	97.3	93.2	83.1	82.0	84.6	80.2	75.6
Mean	85.7	89.0	85.5	89.2	92.7	95.0	97.1	92.9	82.8	82.6	84.7	80.1	76.0
Left Insertion Loss	**0.5**	**-1.4**	**-3.0**	**-4.2**	**-4.7**	**-6.6**	**-8.6**	**-1.5**	**7.3**	**9.4**	**9.2**	**11.3**	**17.2**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.6	88.1	83.6	85.4	86.9	86.4	88.2	89.8	90.5	90.7	93.9	93.5	93.4
Test 2	84.7	88.2	83.8	86.0	87.4	89.5	87.6	89.0	88.8	89.4	93.0	94.5	94.4
Test 3	86.8	88.2	83.7	85.4	87.0	86.2	88.3	89.6	90.6	90.7	94.1	93.6	93.5
Mean	86.0	88.2	83.7	85.6	87.1	87.4	88.0	89.5	90.0	90.3	93.7	93.9	93.8
Error													
Occluded													
Test 1	85.2	88.7	84.9	87.9	90.7	92.6	94.5	95.2	88.1	86.1	85.7	84.3	78.9
Test 2	85.0	88.4	85.0	88.1	90.7	93.1	95.0	95.1	87.8	85.9	85.3	83.8	79.0
Test 3	84.8	88.2	84.9	88.1	90.6	93.1	94.7	95.2	88.3	86.8	86.0	83.7	79.3
Mean	85.0	88.4	85.0	88.0	90.6	92.9	94.8	95.1	88.1	86.3	85.7	83.9	79.1
Right Insertion Loss	**1.0**	**-0.3**	**-1.2**	**-2.4**	**-3.6**	**-5.6**	**-6.7**	**-5.7**	**1.9**	**4.0**	**8.0**	**9.9**	**14.7**
Insertion Loss	**0.8**	**-0.8**	**-2.1**	**-3.3**	**-4.1**	**-6.1**	**-7.7**	**-3.6**	**4.6**	**6.7**	**8.6**	**10.6**	**15.9**

Table J-11. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 13.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	91.4	94.3	95.9	98.4	97.8	99.9	97.6	94.5	92.5	93.6	91.5	81.8	108	108
Test 2	91.1	94.1	96.9	98.7	97.7	100.0	97.9	94.2	92.9	93.8	91.3	81.3	108	108
Test 3	91.3	94.3	96.8	98.1	97.6	99.8	96.7	93.7	93.4	94.3	91.4	81.5	108	108
Mean	91.3	94.2	96.5	98.4	97.7	99.9	97.4	94.1	92.9	93.9	91.4	81.5	108	108
Occluded														
Test 1	68.3	65.7	72.6	67.6	58.7	61.2	57.6	52.2	49.9	57.6	59.2	52.4	102	93
Test 2	68.8	67.4	73.2	65.9	61.1	64.6	59.9	56.3	53.1	62.2	63.5	54.1	102	93
Test 3	68.5	67.3	73.2	66.4	60.9	59.9	56.6	51.2	50.1	59.1	63.2	57.2	102	93
Mean	68.5	66.8	73.0	66.6	60.2	61.9	58.0	53.2	51.0	59.6	62.0	54.6	102	93
Left Insertion Loss	**22.8**	**27.4**	**23.5**	**31.8**	**37.5**	**37.9**	**39.3**	**40.9**	**41.9**	**34.3**	**29.4**	**26.9**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	90.8	92.9	95.5	98.1	98.6	99.1	97.2	94.4	95.0	91.0	89.1	81.9	107	108
Test 2	92.1	92.8	94.9	98.4	98.4	99.5	97.4	94.5	94.5	91.0	89.5	81.6	108	108
Test 3	91.0	93.1	95.7	98.6	98.5	98.8	96.6	93.7	95.1	91.0	89.7	81.4	107	108
Mean	91.3	93.0	95.4	98.4	98.5	99.1	97.0	94.2	94.9	91.0	89.4	81.6	107	
Occluded														
Test 1	71.8	68.3	75.4	77.3	69.8	73.1	71.0	68.7	70.4	69.7	66.3	60.9	101	94
Test 2	71.6	66.6	74.9	76.5	70.4	70.9	67.7	69.3	69.5	68.1	64.2	59.5	101	94
Test 3	71.9	66.3	75.4	77.5	72.2	71.7	70.1	69.2	70.1	70.6	65.3	60.0	101	94
Mean	71.8	67.1	75.2	77.1	70.8	71.9	69.6	69.1	70.0	69.5	65.3	60.1	101	94
Right Insertion Loss	**19.5**	**25.9**	**20.1**	**21.3**	**27.7**	**27.2**	**27.4**	**25.1**	**24.9**	**21.5**	**24.2**	**21.5**		
Insertion Loss	**21.1**	**26.6**	**21.8**	**26.5**	**32.6**	**32.6**	**33.4**	**33.0**	**33.4**	**27.9**	**26.8**	**24.2**		

Table J-12. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 15.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.7	88.1	84.2	88.1	88.9	91.3	86.4	91.9	90.0	90.8	92.8	93.9	94.9
Test 2	85.7	88.1	84.4	88.3	88.9	91.2	86.6	91.7	90.2	90.5	93.0	93.9	94.4
Test 3	85.3	87.9	84.3	88.2	88.4	91.2	86.7	91.5	90.3	90.1	93.1	93.5	94.0
Mean	85.5	88.0	84.3	88.2	88.8	91.2	86.6	91.7	90.2	90.5	93.0	93.8	94.4
Occluded													
Test 1	86.0	88.8	85.6	90.1	92.1	94.8	95.6	97.2	92.7	89.5	83.4	82.5	78.9
Test 2	85.8	88.6	85.5	89.8	91.4	94.6	95.8	98.0	93.3	89.2	83.7	83.2	80.2
Test 3	85.8	88.5	85.6	89.8	91.5	94.6	95.5	97.3	93.5	89.5	85.0	82.9	79.3
Mean	85.8	88.6	85.6	89.9	91.7	94.6	95.6	97.5	93.1	89.4	84.0	82.9	79.5
Left Insertion Loss	**-0.3**	**-0.6**	**-1.3**	**-1.7**	**-2.9**	**-3.4**	**-9.1**	**-5.8**	**-3.0**	**1.1**	**9.0**	**10.9**	**14.9**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	84.6	87.7	83.7	86.7	88.2	90.7	87.5	89.4	91.4	91.8	94.1	91.0	93.8
Test 2	84.5	87.6	83.8	86.7	88.2	90.8	87.7	90.3	91.2	91.7	94.2	91.0	93.2
Test 3	84.2	87.4	83.7	86.7	87.9	90.8	87.7	90.1	91.1	91.9	94.2	91.5	93.4
Mean	84.4	87.5	83.7	86.7	88.1	90.7	87.6	89.9	91.2	91.8	94.2	91.2	93.5
Error													
Occluded													
Test 1	85.6	88.8	85.7	89.9	93.3	95.4	95.0	91.4	85.0	82.2	82.1	78.4	75.5
Test 2	85.8	89.1	86.4	90.7	92.9	94.5	90.4	86.8	79.7	79.0	79.3	75.6	72.4
Test 3	85.5	88.9	86.1	90.3	93.4	95.7	93.4	89.3	82.4	81.1	80.4	76.8	73.0
Mean	85.7	88.9	86.0	90.3	93.2	95.2	93.0	89.2	82.4	80.8	80.6	76.9	73.6
Right Insertion Loss	**-1.2**	**-1.4**	**-2.3**	**-3.6**	**-5.1**	**-4.4**	**-5.3**	**0.7**	**8.9**	**11.0**	**13.6**	**14.3**	**19.8**
Insertion Loss	**-0.8**	**-1.0**	**-1.8**	**-2.6**	**-4.0**	**-3.9**	**-7.2**	**-2.5**	**2.9**	**6.1**	**11.3**	**12.6**	**17.4**

Table J-12. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 15.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	93.2	94.9	95.7	98.7	98.0	99.1	97.1	97.0	94.9	91.7	87.3	78.8	108	108
Test 2	92.7	94.1	95.7	97.6	97.5	98.8	97.8	96.7	94.7	91.3	87.4	78.5	108	108
Test 3	92.6	94.1	96.4	97.5	97.3	99.2	97.8	97.1	95.2	91.5	87.8	78.9	108	108
Mean	92.8	94.3	95.9	98.0	97.6	99.0	97.6	96.9	95.0	91.5	87.5	78.7	108	108
Occluded														
Test 1	70.1	72.4	72.5	76.7	74.9	73.7	73.3	73.7	69.4	64.5	64.4	57.5	103	96
Test 2	71.3	72.9	74.6	78.0	74.6	74.3	73.0	73.1	70.0	64.6	63.0	56.9	103	96
Test 3	72.2	74.9	74.8	77.5	75.3	74.0	75.6	73.6	70.2	64.5	62.0	57.4	103	96
Mean	71.2	73.4	73.9	77.4	74.9	74.0	74.0	73.5	69.9	64.5	63.2	57.3	103	96
Left Insertion Loss	**21.6**	**21.0**	**22.0**	**20.6**	**22.6**	**25.1**	**23.6**	**23.5**	**25.1**	**27.0**	**24.4**	**21.4**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.8	94.5	95.6	97.6	99.1	102.1	100.9	99.0	95.2	90.6	81.3	75.9	109	109
Test 2	92.6	94.5	95.1	97.4	99.3	101.6	100.7	99.1	94.9	91.2	81.3	76.1	109	109
Test 3	92.3	94.3	94.8	97.4	99.8	101.9	100.8	99.7	95.0	91.7	81.3	76.3	109	109
Mean	92.6	94.4	95.2	97.4	99.4	101.9	100.8	99.3	95.0	91.2	81.3	76.1	109	
Occluded														
Test 1	68.1	70.0	69.6	70.8	65.5	65.6	64.7	63.9	62.2	56.6	53.8	55.3	101	92
Test 2	65.2	69.1	69.5	68.1	62.1	59.9	61.4	61.6	59.7	54.7	53.7	55.5	100	89
Test 3	66.2	69.2	69.2	69.2	63.9	64.1	63.1	61.8	60.7	56.3	53.8	55.6	101	91
Mean	66.5	69.4	69.4	69.4	63.8	63.2	63.1	62.4	60.9	55.9	53.8	55.5	101	90
Right Insertion Loss	**26.1**	**25.0**	**25.7**	**28.1**	**35.6**	**38.7**	**37.7**	**36.9**	**34.1**	**35.3**	**27.5**	**20.7**		
Insertion Loss	**23.8**	**23.0**	**23.9**	**24.3**	**29.1**	**31.9**	**30.7**	**30.2**	**29.6**	**31.1**	**26.0**	**21.1**		

Table J-13. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 16.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.3	87.9	83.7	87.3	88.3	90.8	86.9	91.9	89.8	92.0	92.8	93.4	92.4
Test 2	87.6	87.9	83.4	86.7	88.3	90.7	87.2	93.1	91.1	93.1	93.7	93.6	93.0
Test 3	85.3	87.6	83.8	87.7	88.0	91.2	86.3	92.5	90.9	91.8	93.6	94.4	92.5
Mean	86.1	87.8	83.6	87.3	88.2	90.9	86.8	92.5	90.6	92.3	93.4	93.8	92.7
Occluded													
Test 1	88.6	89.6	85.8	90.1	92.5	94.1	96.7	95.2	88.9	85.0	80.5	79.7	74.2
Test 2	86.6	89.6	86.6	91.5	93.6	96.0	94.5	91.7	83.7	80.9	80.0	78.1	73.0
Test 3	86.5	89.5	86.7	91.2	92.8	95.6	91.6	87.9	79.4	77.5	79.7	77.7	72.5
Mean	87.2	89.6	86.4	91.0	93.0	95.2	94.2	91.6	84.0	81.1	80.0	78.5	73.2
Left Insertion Loss	**-1.2**	**-1.7**	**-2.7**	**-3.7**	**-4.8**	**-4.4**	**-7.4**	**0.9**	**6.6**	**11.2**	**13.3**	**15.3**	**19.4**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	84.4	87.7	83.9	87.0	87.7	90.5	87.5	91.7	91.7	91.0	93.5	92.1	92.3
Test 2	86.7	87.8	83.6	86.2	87.1	85.6	88.4	91.6	92.4	91.1	94.1	90.3	92.6
Test 3	84.4	87.7	83.8	86.8	87.6	90.1	87.3	91.4	91.0	90.7	93.3	91.1	92.9
Mean	85.2	87.8	83.8	86.6	87.5	88.7	87.7	91.6	91.7	90.9	93.6	91.1	92.6
Error													
Occluded													
Test 1	88.1	89.9	86.6	90.7	93.1	90.5	91.1	89.6	83.4	79.8	79.6	74.4	69.1
Test 2	85.4	88.9	85.9	90.5	93.4	95.2	95.2	93.8	86.8	82.5	81.3	76.5	72.8
Test 3	85.0	88.5	85.6	90.0	92.5	95.3	96.5	96.9	89.3	84.5	81.7	77.9	75.6
Mean	86.2	89.1	86.0	90.4	93.0	93.6	94.3	93.4	86.5	82.3	80.8	76.3	72.5
Right Insertion Loss	**-1.1**	**-1.4**	**-2.3**	**-3.7**	**-5.5**	**-4.9**	**-6.5**	**-1.9**	**5.1**	**8.7**	**12.8**	**14.9**	**20.1**
Insertion Loss	**-1.1**	**-1.5**	**-2.5**	**-3.7**	**-5.2**	**-4.6**	**-7.0**	**-0.5**	**5.9**	**9.9**	**13.1**	**15.1**	**19.8**

Table J-13. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 16.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	92.4	95.1	97.0	99.3	100.5	102.7	101.9	99.3	96.6	89.8	87.9	80.0	110	110
Test 2	93.0	95.3	97.9	99.1	100.5	102.6	101.4	99.3	95.3	87.4	90.5	80.7	110	110
Test 3	93.7	96.8	98.4	99.4	100.9	103.0	102.3	99.3	96.6	89.0	91.1	81.1	110	111
Mean	93.0	95.7	97.8	99.3	100.6	102.8	101.8	99.3	96.1	88.7	89.8	80.6	110	110
Occluded														
Test 1	69.4	67.3	71.6	67.9	60.9	62.3	61.9	62.9	50.3	56.9	52.6	50.7	102	94
Test 2	69.6	68.1	70.8	65.8	62.5	62.9	65.4	71.6	60.7	50.0	50.0	49.7	102	92
Test 3	66.6	69.1	72.4	66.2	60.9	62.8	66.4	64.4	51.4	53.3	51.0	47.6	100	90
Mean	68.5	68.2	71.6	66.6	61.5	62.7	64.6	66.3	54.1	53.4	51.2	49.3	101	92
Left Insertion Loss	**24.5**	**27.6**	**26.1**	**32.6**	**39.2**	**40.1**	**37.3**	**33.0**	**42.0**	**35.3**	**38.7**	**31.3**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.8	95.1	95.7	99.1	99.5	102.2	101.5	98.3	93.1	90.7	88.3	80.1	109	109
Test 2	91.8	93.4	95.5	98.3	99.8	101.7	100.0	98.1	91.6	92.6	87.9	81.0	109	109
Test 3	92.8	94.1	96.0	98.2	99.5	102.2	99.9	98.3	92.8	93.4	87.6	80.2	109	109
Mean	92.5	94.2	95.7	98.5	99.6	102.0	100.5	98.2	92.5	92.3	87.9	80.4	109	
Occluded														
Test 1	63.2	65.4	70.8	61.8	58.2	61.6	60.0	54.6	58.1	51.7	54.5	56.2	100	89
Test 2	68.4	68.2	70.6	63.1	60.5	64.4	64.1	65.7	63.2	52.8	54.7	55.7	102	92
Test 3	71.1	68.5	73.5	65.6	62.6	64.3	68.2	68.2	61.9	53.9	54.0	54.8	103	94
Mean	67.6	67.4	71.6	63.5	60.4	63.4	64.1	62.8	61.1	52.8	54.4	55.6	101	92
Right Insertion Loss	**24.9**	**26.9**	**24.1**	**35.0**	**39.2**	**38.6**	**36.4**	**35.4**	**31.5**	**39.4**	**33.5**	**24.8**		
Insertion Loss	**24.7**	**27.2**	**25.1**	**33.8**	**39.2**	**39.4**	**36.8**	**34.2**	**36.7**	**37.4**	**36.1**	**28.1**		

Table J-14. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 17.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.6	88.0	83.4	86.5	88.8	90.0	88.8	91.0	90.4	92.3	93.7	92.8	93.2
Test 2	85.9	88.3	83.4	86.7	88.9	90.2	88.7	91.2	90.3	92.7	93.9	92.2	93.4
Test 3	85.6	87.9	83.3	86.5	88.6	90.5	88.7	91.5	91.1	92.8	94.3	93.6	94.5
Mean	85.7	88.1	83.4	86.6	88.8	90.2	88.8	91.2	90.6	92.6	94.0	92.9	93.7
Occluded													
Test 1	88.2	88.6	84.0	86.7	92.1	92.3	93.3	91.5	86.8	86.0	84.8	80.0	76.3
Test 2	88.6	88.7	83.7	86.9	92.6	93.1	94.3	93.1	88.4	86.8	85.2	81.2	76.9
Test 3	86.0	88.1	83.8	87.8	91.9	93.8	94.8	94.4	88.6	87.0	86.4	81.8	78.0
Mean	87.6	88.5	83.8	87.1	92.2	93.0	94.1	93.0	87.9	86.6	85.5	81.0	77.1
Left Insertion Loss	**-1.9**	**-0.4**	**-0.5**	**-0.6**	**-3.4**	**-2.8**	**-5.3**	**-1.8**	**2.7**	**6.0**	**8.5**	**11.9**	**16.7**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	84.5	87.7	83.8	86.3	87.6	89.9	88.7	89.7	90.5	91.7	95.1	93.6	94.0
Test 2	85.0	88.1	83.7	86.1	87.7	89.3	88.3	88.7	90.1	91.1	94.8	94.2	94.5
Test 3	84.9	87.9	83.7	86.0	87.6	88.6	88.2	88.9	89.1	90.9	93.9	94.3	94.8
Mean	84.8	87.9	83.7	86.1	87.6	89.3	88.4	89.1	89.9	91.2	94.6	94.0	94.4
Error													
Occluded													
Test 1	85.6	86.2	81.5	83.0	83.6	81.3	83.8	80.2	78.1	80.0	77.0	74.7	70.1
Test 2	87.0	87.6	83.6	85.4	86.9	84.5	87.0	83.3	79.9	81.6	76.8	75.9	70.9
Test 3	84.6	87.1	83.2	85.1	85.8	85.7	84.2	81.0	77.7	79.7	76.6	75.0	69.2
Mean	85.8	87.0	82.8	84.5	85.4	83.8	85.0	81.5	78.5	80.4	76.8	75.2	70.1
Right Insertion Loss	**-1.0**	**0.9**	**0.9**	**1.6**	**2.2**	**5.5**	**3.4**	**7.6**	**11.3**	**10.8**	**17.8**	**18.8**	**24.4**
Insertion Loss	**-1.4**	**0.2**	**0.2**	**0.5**	**-0.6**	**1.3**	**-1.0**	**2.9**	**7.0**	**8.4**	**13.2**	**15.3**	**20.5**

Table J-14. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 17.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.1	95.4	96.4	96.6	98.7	101.0	99.7	95.9	91.7	88.8	87.9	78.4	108	109
Test 2	91.3	95.2	95.8	97.1	98.7	100.8	99.8	95.0	90.6	90.2	88.9	80.2	108	108
Test 3	91.1	94.8	96.1	97.2	98.9	100.5	100.4	95.6	90.9	90.3	89.2	80.1	108	109
Mean	91.2	95.1	96.1	97.0	98.7	100.8	100.0	95.5	91.0	89.8	88.7	79.5	108	109
Occluded														
Test 1	70.4	72.8	79.0	81.0	78.1	74.5	69.1	65.0	59.5	61.2	61.1	52.2	100	93
Test 2	71.8	75.3	80.9	82.4	79.8	76.1	70.3	63.5	59.6	59.1	62.1	52.8	101	94
Test 3	71.3	74.6	81.2	81.4	80.9	77.9	72.0	67.2	63.5	60.7	60.6	51.7	101	95
Mean	71.2	74.2	80.4	81.6	79.6	76.2	70.4	65.2	60.9	60.3	61.3	52.2	101	94
Left Insertion Loss	**20.0**	**20.9**	**15.7**	**15.4**	**19.1**	**24.6**	**29.5**	**30.3**	**30.2**	**29.5**	**27.4**	**27.3**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	90.4	92.3	95.6	96.5	98.1	99.1	99.2	96.3	91.3	89.4	87.1	78.0	108	108
Test 2	90.5	93.0	96.0	96.6	97.8	98.7	98.2	95.5	91.2	89.4	86.8	77.6	107	107
Test 3	90.6	91.2	94.6	96.4	96.6	98.2	98.0	93.7	90.5	89.8	85.4	78.0	107	107
Mean	90.5	92.1	95.4	96.5	97.5	98.7	98.5	95.2	91.0	89.5	86.4	77.9	107	
Occluded														
Test 1	62.1	69.8	70.3	69.8	64.8	64.0	65.7	61.3	55.1	55.2	54.7	56.4	93	85
Test 2	62.3	69.8	69.9	70.4	66.6	66.4	66.5	63.0	56.4	56.1	54.7	56.5	95	86
Test 3	62.1	69.6	68.1	68.4	64.9	65.0	65.9	60.2	54.7	55.0	54.5	55.5	94	85
Mean	62.2	69.7	69.4	69.5	65.4	65.1	66.0	61.5	55.4	55.4	54.6	56.2	94	86
Right Insertion Loss	**28.3**	**22.4**	**26.0**	**27.0**	**32.1**	**33.6**	**32.5**	**33.7**	**35.6**	**34.1**	**31.8**	**21.7**		
Insertion Loss	**24.2**	**21.6**	**20.8**	**21.2**	**25.6**	**29.1**	**31.0**	**32.0**	**32.9**	**31.8**	**29.6**	**24.5**		

Table J-15. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 18.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.7	89.6	85.5	88.5	89.8	91.7	88.9	91.7	90.4	91.3	93.9	93.0	95.1
Test 2	89.1	90.1	85.1	87.7	90.2	87.9	89.0	91.6	91.6	92.1	91.5	93.5	95.5
Test 3	89.2	90.2	85.2	87.8	90.3	87.9	89.4	91.4	91.7	91.8	91.9	93.8	95.0
Mean	88.4	90.0	85.3	88.0	90.1	89.2	89.1	91.6	91.2	91.8	92.4	93.5	95.2
Occluded													
Test 1	87.8	91.0	87.2	90.9	93.7	95.7	97.9	96.6	90.3	87.4	85.3	83.2	80.8
Test 2	87.4	90.6	87.0	90.8	93.3	95.6	97.6	98.3	94.3	88.5	85.0	84.2	79.4
Test 3	89.6	90.8	87.0	90.2	93.1	91.7	98.0	98.0	95.9	90.4	85.0	84.0	80.7
Mean	88.2	90.8	87.0	90.6	93.4	94.3	97.8	97.6	93.5	88.8	85.1	83.8	80.3
Left Insertion Loss	**0.1**	**-0.9**	**-1.8**	**-2.6**	**-3.3**	**-5.2**	**-8.7**	**-6.1**	**-2.2**	**3.0**	**7.3**	**9.7**	**14.9**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.6	89.1	85.3	87.8	88.2	92.1	88.8	91.3	90.8	92.3	94.2	94.2	95.1
Test 2	87.3	88.8	84.8	87.0	88.0	89.2	89.8	91.6	93.4	93.2	93.5	94.0	94.7
Test 3	87.6	89.1	84.9	87.2	88.0	89.6	89.9	92.7	93.2	92.6	93.3	94.2	95.0
Mean	86.8	89.0	85.0	87.3	88.1	90.3	89.5	91.9	92.5	92.7	93.7	94.1	94.9
Error													
Occluded													
Test 1	86.8	90.4	87.0	90.7	93.3	96.4	97.4	96.1	89.8	81.4	79.6	77.5	74.3
Test 2	86.6	90.2	87.2	91.2	94.1	98.0	97.0	93.7	87.6	78.4	78.3	78.1	73.9
Test 3	88.8	90.3	87.0	90.4	93.3	93.4	96.9	94.2	88.3	80.9	80.5	78.0	75.2
Mean	87.4	90.3	87.0	90.8	93.6	95.9	97.1	94.7	88.6	80.2	79.4	77.9	74.5
Right Insertion Loss	**-0.6**	**-1.3**	**-2.0**	**-3.4**	**-5.5**	**-5.6**	**-7.6**	**-2.8**	**3.9**	**12.5**	**14.2**	**16.3**	**20.4**
Insertion Loss	**-0.2**	**-1.1**	**-1.9**	**-3.0**	**-4.4**	**-5.4**	**-8.2**	**-4.4**	**0.8**	**7.7**	**10.8**	**13.0**	**17.7**

Table J-15. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 18.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	91.0	93.9	95.3	97.6	97.9	99.5	97.2	93.1	95.7	93.6	88.2	79.8	108	108
Test 2	91.7	94.3	96.0	98.0	97.5	100.3	97.8	94.7	96.1	95.8	89.1	78.4	108	108
Test 3	91.7	94.0	95.8	97.7	96.8	99.3	94.0	94.9	95.6	94.0	90.7	81.4	108	108
Mean	91.5	94.0	95.7	97.8	97.4	99.7	96.3	94.2	95.8	94.4	89.4	79.9	108	108
Occluded														
Test 1	71.0	66.5	71.5	69.2	67.6	69.7	67.2	61.2	58.0	57.1	55.6	48.7	104	96
Test 2	72.8	73.1	75.5	73.3	76.3	79.2	78.5	69.0	65.8	65.2	61.4	51.6	104	97
Test 3	75.6	74.6	74.2	73.0	74.7	80.5	76.0	68.5	65.6	64.0	63.2	54.1	104	97
Mean	73.1	71.4	73.7	71.8	72.9	76.5	73.9	66.2	63.1	62.1	60.1	51.5	104	97
Left Insertion Loss	**18.3**	**22.7**	**22.0**	**25.9**	**24.5**	**23.2**	**22.5**	**28.0**	**32.7**	**32.3**	**29.3**	**28.4**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.8	93.1	94.6	96.5	96.9	98.7	94.7	96.2	96.9	93.0	85.0	80.3	107	107
Test 2	91.7	94.0	96.1	96.3	97.0	98.5	94.4	97.3	97.7	94.3	86.3	78.9	108	108
Test 3	91.8	93.6	96.0	96.3	96.1	96.0	95.2	97.6	97.7	94.8	86.8	78.5	108	107
Mean	91.8	93.6	95.6	96.4	96.6	97.7	94.8	97.0	97.5	94.0	86.0	79.2	108	
Occluded														
Test 1	64.6	65.2	69.5	67.6	66.9	64.6	64.9	63.1	59.0	54.6	55.8	54.5	103	94
Test 2	61.7	62.2	68.4	67.1	64.3	61.3	58.2	57.1	57.3	54.4	54.0	53.3	103	93
Test 3	63.9	63.1	67.7	66.6	63.4	59.6	56.0	56.8	57.2	53.9	53.6	53.9	102	93
Mean	63.4	63.5	68.5	67.1	64.9	61.8	59.7	59.0	57.8	54.3	54.5	53.9	103	93
Right Insertion Loss	**28.4**	**30.1**	**27.0**	**29.3**	**31.8**	**35.9**	**35.0**	**38.1**	**39.6**	**39.7**	**31.5**	**25.3**		
Insertion Loss	**23.4**	**26.4**	**24.5**	**27.6**	**28.1**	**29.5**	**28.8**	**33.0**	**36.2**	**36.0**	**30.4**	**26.9**		

Table J-16. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 19.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.9	89.4	85.1	88.6	89.7	92.2	87.6	92.6	91.1	91.4	93.5	94.9	95.8
Test 2	88.9	88.9	85.0	88.4	89.2	91.3	87.9	94.1	92.5	92.6	93.7	94.7	95.4
Test 3	86.6	88.9	85.3	89.2	89.2	92.1	87.5	93.2	91.9	92.1	93.8	95.2	95.0
Mean	87.5	89.1	85.1	88.7	89.4	91.9	87.7	93.3	91.8	92.1	93.6	94.9	95.4
Occluded													
Test 1	87.9	90.6	88.3	92.8	92.7	94.5	88.5	86.0	79.8	78.3	79.7	74.2	69.8
Test 2	87.4	90.1	87.4	92.2	93.8	96.9	95.2	94.2	87.4	83.1	83.0	78.5	71.9
Test 3	87.3	89.7	87.1	91.8	93.4	96.4	97.3	98.3	92.5	87.7	85.7	81.1	74.5
Mean	87.5	90.1	87.6	92.3	93.3	95.9	93.6	92.8	86.6	83.0	82.8	77.9	72.1
Left Insertion Loss	**-0.1**	**-1.0**	**-2.5**	**-3.5**	**-3.9**	**-4.1**	**-5.9**	**0.5**	**5.3**	**9.0**	**10.8**	**17.0**	**23.3**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.7	89.0	84.8	87.6	88.7	91.3	87.9	91.3	91.2	91.7	94.2	91.6	93.1
Test 2	87.8	88.8	84.4	86.7	88.2	86.3	88.4	91.3	92.0	92.7	94.0	91.7	94.4
Test 3	85.7	88.9	84.7	87.5	88.7	90.9	87.4	90.8	90.8	92.0	93.7	91.9	94.8
Mean	86.4	88.9	84.7	87.3	88.5	89.5	87.9	91.1	91.3	92.1	94.0	91.7	94.1
Error													
Occluded													
Test 1	86.3	89.4	86.7	90.9	93.8	96.9	96.4	94.7	86.4	81.4	81.3	80.4	77.5
Test 2	86.4	89.5	86.3	90.4	93.2	95.9	97.3	97.2	89.3	84.6	83.5	81.7	78.9
Test 3	86.3	89.2	86.1	90.0	92.8	95.2	97.3	98.3	91.6	86.9	84.9	83.2	80.8
Mean	86.3	89.4	86.4	90.4	93.3	96.0	97.0	96.7	89.1	84.3	83.2	81.8	79.1
Right Insertion Loss	**0.1**	**-0.5**	**-1.7**	**-3.2**	**-4.8**	**-6.5**	**-9.1**	**-5.6**	**2.2**	**7.8**	**10.7**	**10.0**	**15.0**
Insertion Loss	**0.0**	**-0.7**	**-2.1**	**-3.4**	**-4.3**	**-5.3**	**-7.5**	**-2.6**	**3.8**	**8.4**	**10.8**	**13.5**	**19.2**

Table J-16. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 19.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	93.1	95.8	96.6	97.0	97.0	99.4	96.9	90.9	92.8	93.4	89.4	79.2	108	108
Test 2	93.2	95.9	97.2	96.6	97.8	99.9	95.1	92.5	92.6	92.4	89.5	78.8	108	108
Test 3	93.6	95.7	96.8	97.0	97.4	99.8	95.1	92.3	93.5	92.1	89.4	79.5	108	108
Mean	93.3	95.8	96.9	96.9	97.4	99.7	95.7	91.9	93.0	92.6	89.4	79.2	108	108
Occluded														
Test 1	63.1	69.1	69.4	63.1	63.6	62.1	58.8	50.4	48.9	49.2	51.2	50.8	100	89
Test 2	65.1	69.3	68.1	68.0	72.4	70.8	67.9	63.1	62.2	57.9	56.7	50.3	103	94
Test 3	67.4	69.2	68.7	68.8	73.9	74.6	73.5	66.7	63.3	60.5	56.3	49.8	104	96
Mean	65.2	69.2	68.7	66.6	69.9	69.2	66.7	60.1	58.1	55.9	54.7	50.3	102	93
Left Insertion Loss	**28.1**	**26.6**	**28.2**	**30.3**	**27.5**	**30.5**	**29.0**	**31.8**	**34.8**	**36.7**	**34.7**	**28.9**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	93.4	95.6	94.6	96.1	96.5	99.9	98.5	90.9	93.4	93.4	87.4	78.9	107	107
Test 2	91.7	94.0	94.6	96.1	97.5	98.5	95.7	91.5	93.2	93.0	87.9	78.5	107	107
Test 3	92.0	94.6	94.2	96.5	97.5	98.7	96.9	90.9	93.1	92.6	87.6	78.3	107	107
Mean	92.4	94.8	94.5	96.2	97.1	99.0	97.1	91.1	93.3	93.0	87.6	78.6	107	
Occluded														
Test 1	69.1	71.1	71.3	69.9	69.3	66.7	66.4	60.3	62.0	56.4	55.4	56.5	103	93
Test 2	69.9	70.6	71.2	69.8	68.0	68.3	67.4	63.9	63.1	59.3	57.8	55.9	103	95
Test 3	71.2	71.2	72.5	71.5	70.2	71.5	71.8	68.6	60.8	59.6	57.5	56.0	104	96
Mean	70.1	70.9	71.7	70.4	69.2	68.8	68.5	64.3	62.0	58.4	56.9	56.1	103	95
Right Insertion Loss	**22.3**	**23.8**	**22.8**	**25.8**	**28.0**	**30.2**	**28.5**	**26.9**	**31.3**	**34.6**	**30.7**	**22.5**		
Insertion Loss	**25.2**	**25.2**	**25.5**	**28.0**	**27.7**	**30.4**	**28.8**	**29.3**	**33.1**	**35.7**	**32.7**	**25.7**		

Table J-17. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 20.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.0	88.6	84.2	87.2	88.9	90.5	88.1	92.4	89.7	92.2	94.2	92.7	93.7
Test 2	86.3	88.7	84.0	87.2	89.2	89.1	88.9	91.1	89.0	91.3	92.7	91.6	94.4
Test 3	86.5	89.2	84.2	87.1	89.4	88.4	89.0	90.7	89.5	91.8	94.0	91.7	93.7
Mean	86.2	88.8	84.1	87.2	89.2	89.3	88.7	91.4	89.4	91.8	93.7	92.0	93.9
Occluded													
Test 1	88.5	89.3	85.6	88.4	91.4	90.2	96.7	98.4	95.9	91.0	89.1	82.8	79.3
Test 2	86.4	89.2	85.6	89.0	91.6	92.6	96.7	98.3	94.3	89.9	89.6	83.9	80.5
Test 3	88.7	89.6	85.4	88.1	91.8	89.7	96.6	97.8	95.7	91.4	89.9	83.4	80.8
Mean	87.9	89.4	85.6	88.5	91.6	90.9	96.7	98.2	95.3	90.8	89.5	83.4	80.2
Left Insertion Loss	**-1.6**	**-0.5**	**-1.4**	**-1.3**	**-2.4**	**-1.5**	**-8.0**	**-6.8**	**-5.9**	**1.0**	**4.1**	**8.6**	**13.8**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	85.3	88.6	84.6	86.9	88.0	90.7	88.1	89.1	90.9	91.1	94.7	92.4	94.1
Test 2	85.1	88.2	84.3	86.8	88.1	91.0	89.0	90.7	91.7	91.6	94.9	93.8	93.0
Test 3	85.2	88.4	84.5	86.8	88.0	91.3	89.2	90.9	91.7	91.1	94.1	94.7	94.1
Mean	85.2	88.4	84.5	86.8	88.1	91.0	88.8	90.2	91.4	91.3	94.6	93.6	93.7
Error													
Occluded													
Test 1	87.9	89.3	86.5	89.1	91.9	92.1	96.7	95.1	88.9	81.7	80.8	73.7	69.7
Test 2	85.6	89.0	86.3	89.5	91.8	95.0	95.9	94.6	87.5	80.8	79.4	74.9	69.9
Test 3	87.9	89.3	86.4	89.0	91.8	92.2	96.8	95.8	89.4	81.2	80.4	74.5	70.4
Mean	87.1	89.2	86.4	89.2	91.8	93.1	96.4	95.2	88.6	81.2	80.2	74.4	70.0
Right Insertion Loss	**-1.9**	**-0.8**	**-1.9**	**-2.3**	**-3.8**	**-2.1**	**-7.7**	**-4.9**	**2.8**	**10.1**	**14.3**	**19.3**	**23.7**
Insertion Loss	**-1.8**	**-0.7**	**-1.7**	**-1.8**	**-3.1**	**-1.8**	**-7.8**	**-5.8**	**-1.6**	**5.5**	**9.2**	**13.9**	**18.8**

Table J-17. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 20.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	89.8	94.3	97.4	97.8	98.4	102.2	100.4	95.8	91.1	91.7	88.6	80.4	109	109
Test 2	91.8	95.7	97.7	98.0	97.1	101.7	101.3	96.9	93.4	90.7	88.6	80.1	109	109
Test 3	92.5	94.8	97.6	97.2	98.4	101.4	100.0	95.2	92.2	91.1	89.1	81.6	108	109
Mean	91.3	94.9	97.6	97.7	98.0	101.8	100.6	96.0	92.2	91.2	88.8	80.7	109	109
Occluded														
Test 1	77.3	78.8	76.9	76.6	81.1	82.6	83.3	71.9	71.7	67.6	59.9	51.4	104	98
Test 2	78.2	78.8	76.8	75.8	79.5	82.6	82.0	71.8	72.0	68.2	61.7	52.9	104	98
Test 3	78.4	77.9	76.1	76.3	80.3	82.1	80.1	68.6	73.0	69.2	62.1	52.9	104	98
Mean	78.0	78.5	76.6	76.3	80.3	82.4	81.8	70.8	72.3	68.3	61.3	52.4	104	98
Left Insertion Loss	**13.4**	**16.4**	**21.0**	**21.4**	**17.7**	**19.3**	**18.8**	**25.2**	**19.9**	**22.8**	**27.5**	**28.3**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.4	94.1	96.6	97.6	99.2	101.4	98.4	92.1	93.2	93.9	88.7	80.6	108	108
Test 2	91.6	93.6	95.1	98.2	99.3	103.1	99.6	90.7	94.6	94.6	89.2	81.2	109	109
Test 3	91.2	93.5	95.7	98.2	98.3	101.6	100.0	91.2	94.5	94.9	89.1	81.8	108	109
Mean	91.4	93.8	95.8	98.0	98.9	102.0	99.3	91.3	94.1	94.5	89.0	81.2	108	
Occluded														
Test 1	67.3	66.2	69.1	67.7	65.8	68.6	65.7	63.1	70.5	67.2	63.4	55.7	102	93
Test 2	67.5	65.9	68.5	67.0	66.8	70.1	66.7	62.2	70.8	67.3	63.3	55.5	102	92
Test 3	66.4	66.6	68.0	67.3	65.6	69.1	67.8	64.8	71.5	68.6	64.1	55.8	102	93
Mean	67.1	66.3	68.5	67.3	66.1	69.3	66.7	63.4	70.9	67.7	63.6	55.7	102	93
Right Insertion Loss	**24.3**	**27.5**	**27.2**	**30.7**	**32.9**	**32.8**	**32.6**	**27.9**	**23.2**	**26.8**	**25.4**	**25.5**		
Insertion Loss	**18.9**	**22.0**	**24.1**	**26.0**	**25.3**	**26.0**	**25.7**	**26.6**	**21.6**	**24.8**	**26.5**	**26.9**		

Table J-18. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 22.

Left	63	80	100	125	160	200	250	315	400	500	630	800	1000
Unoccluded													
Test 1	88.8	89.5	84.5	87.2	90.0	89.4	89.4	92.4	91.6	92.8	93.1	92.6	94.4
Test 2	88.8	89.6	84.7	87.5	90.1	89.3	89.2	93.0	91.6	92.7	92.1	92.7	94.1
Test 3	88.9	89.6	84.5	87.2	90.2	89.5	89.3	93.0	91.8	93.5	93.4	92.2	94.0
Mean	88.9	89.6	84.6	87.3	90.1	89.4	89.3	92.8	91.7	93.0	92.9	92.5	94.2
Occluded													
Test 1	87.0	89.8	85.6	89.1	92.0	92.4	93.2	92.2	92.0	93.4	93.5	87.9	85.3
Test 2	87.2	90.0	85.5	89.1	92.1	92.1	93.2	92.8	92.0	94.4	93.4	87.9	86.0
Test 3	87.5	90.1	84.8	88.2	92.1	90.8	93.3	93.8	92.9	95.0	95.5	87.1	84.8
Mean	87.2	90.0	85.3	88.8	92.1	91.7	93.2	92.9	92.3	94.2	94.2	87.6	85.4
Left Insertion Loss	**1.7**	**-0.4**	**-0.7**	**-1.5**	**-2.0**	**-2.3**	**-4.0**	**-0.2**	**-0.6**	**-1.2**	**-1.3**	**4.9**	**8.8**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.8	89.1	85.0	87.1	88.2	87.9	89.2	92.0	92.9	92.6	95.7	93.9	93.6
Test 2	87.7	89.1	85.0	87.1	88.2	88.2	89.3	91.9	93.0	92.5	95.8	94.1	94.5
Test 3	87.8	89.1	85.0	87.1	88.3	87.8	89.2	91.7	92.8	92.3	95.8	93.5	93.5
Mean	87.8	89.1	85.0	87.1	88.2	88.0	89.3	91.9	92.9	92.5	95.8	93.8	93.9
Error													
Occluded													
Test 1	85.9	89.1	85.3	88.3	90.3	92.0	91.5	93.0	91.5	91.3	92.5	90.0	91.6
Test 2	86.0	89.3	85.3	88.3	90.5	91.8	91.8	93.6	92.7	91.9	91.9	88.9	89.1
Test 3	86.7	89.8	85.3	88.0	90.9	90.9	92.6	94.8	92.4	91.1	91.7	89.1	86.5
Mean	86.2	89.4	85.3	88.2	90.5	91.6	92.0	93.8	92.2	91.5	92.0	89.3	89.0
Right Insertion Loss	**1.5**	**-0.3**	**-0.4**	**-1.1**	**-2.3**	**-3.6**	**-2.7**	**-1.9**	**0.7**	**1.0**	**3.7**	**4.5**	**4.8**
Insertion Loss	**1.6**	**-0.3**	**-0.5**	**-1.3**	**-2.2**	**-3.0**	**-3.3**	**-1.0**	**0.0**	**-0.1**	**1.2**	**4.7**	**6.8**

Table J-18. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 22.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	89.8	94.6	96.0	96.6	98.5	99.5	100.9	97.0	93.2	89.9	86.7	79.5	108	109
Test 2	89.8	94.1	95.9	96.6	98.8	99.3	98.8	94.9	92.6	91.8	89.0	79.1	108	108
Test 3	90.2	94.4	95.9	96.7	98.3	98.8	99.6	93.9	94.0	92.5	89.9	79.9	108	108
Mean	89.9	94.4	95.9	96.6	98.5	99.2	99.8	95.3	93.3	91.4	88.5	79.5	108	108
Occluded														
Test 1	79.5	79.7	84.5	86.0	84.3	77.0	75.3	75.4	67.4	61.5	56.6	52.7	103	98
Test 2	79.4	79.0	85.1	86.2	83.3	75.9	75.7	74.4	67.2	62.3	59.3	53.8	103	98
Test 3	80.5	82.1	87.7	87.8	85.0	78.1	77.3	76.4	68.7	65.0	61.1	54.0	103	99
Mean	79.8	80.3	85.8	86.7	84.2	77.0	76.1	75.4	67.8	62.9	59.0	53.5	103	99
Left Insertion Loss	**10.2**	**14.1**	**10.2**	**10.0**	**14.4**	**22.2**	**23.7**	**19.8**	**25.5**	**28.5**	**29.5**	**26.0**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	90.3	93.6	95.7	97.3	96.8	99.9	99.6	97.0	91.7	89.6	85.6	79.4	108	108
Test 2	90.4	92.9	95.3	97.0	96.7	100.1	100.0	97.7	92.2	89.3	85.1	78.0	108	108
Test 3	90.2	93.4	95.6	97.1	97.4	100.2	99.9	97.9	92.9	90.0	85.3	78.0	108	108
Mean	90.3	93.3	95.5	97.2	97.0	100.1	99.8	97.5	92.3	89.6	85.3	78.5	108	
Occluded														
Test 1	88.5	88.9	87.1	91.2	92.3	86.4	82.6	77.8	76.3	77.8	73.4	67.7	103	101
Test 2	86.5	86.8	85.5	90.3	92.9	89.7	86.1	88.3	79.6	75.5	74.2	66.0	103	101
Test 3	77.7	75.3	81.5	86.3	85.2	79.8	79.5	79.7	69.6	65.4	63.6	54.9	102	98
Mean	84.2	83.7	84.7	89.3	90.1	85.3	82.8	81.9	75.2	72.9	70.4	62.9	103	100
Right Insertion Loss	**6.1**	**9.6**	**10.8**	**7.9**	**6.8**	**14.8**	**17.1**	**15.6**	**17.1**	**16.7**	**14.9**	**15.6**		
Insertion Loss	**8.1**	**11.9**	**10.5**	**8.9**	**10.6**	**18.5**	**20.4**	**17.7**	**21.3**	**22.6**	**22.2**	**20.8**		

Table J-19. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 24.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	87.3	91.1	86.9	89.6	90.2	92.3	88.9	90.4	91.5	93.6	97.0	95.2	96.5
Test 2	89.3	91.0	86.7	89.0	89.6	89.8	90.3	92.7	93.5	95.3	96.6	95.5	96.0
Test 3	87.2	91.0	86.8	89.6	90.1	93.1	89.4	91.0	92.3	94.0	96.8	95.7	96.1
Mean	87.9	91.0	86.8	89.4	90.0	91.7	89.6	91.4	92.4	94.3	96.8	95.5	96.2
Occluded													
Test 1	78.9	79.2	76.6	79.5	78.5	76.5	76.7	76.7	75.1	80.9	77.7	68.2	64.3
Test 2	76.9	79.2	77.0	79.7	78.1	79.4	76.3	74.9	74.3	79.6	78.4	69.0	63.8
Test 3	75.6	78.5	76.6	79.2	77.2	79.2	76.6	75.3	74.4	79.5	78.2	69.1	65.1
Mean	77.1	79.0	76.7	79.5	77.9	78.4	76.6	75.7	74.6	80.0	78.1	68.8	64.4
Left Insertion Loss	**10.8**	**12.1**	**10.1**	**9.9**	**12.1**	**13.4**	**13.0**	**15.7**	**17.8**	**14.3**	**18.7**	**26.7**	**31.8**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.5	89.6	84.7	87.7	89.7	90.1	88.4	90.6	89.4	93.1	95.5	90.6	94.0
Test 2	88.7	89.6	84.2	86.7	89.8	89.0	89.0	91.8	90.7	94.0	95.0	91.3	93.7
Test 3	86.6	89.7	84.7	87.7	89.6	90.1	88.0	90.5	89.3	92.9	94.8	91.5	94.7
Mean	87.3	89.6	84.5	87.4	89.7	89.7	88.5	91.0	89.8	93.3	95.1	91.1	94.2
Error													
Occluded													
Test 1	90.3	92.3	87.4	90.2	89.8	86.5	85.9	81.0	74.8	81.2	80.1	73.2	67.4
Test 2	88.0	91.7	87.6	90.7	89.7	88.4	85.0	81.1	74.7	80.7	80.5	73.3	69.1
Test 3	87.8	91.5	87.6	90.6	89.6	88.6	84.7	81.0	74.6	80.4	81.0	73.7	68.7
Mean	88.7	91.8	87.5	90.5	89.7	87.8	85.2	81.0	74.7	80.7	80.5	73.4	68.4
Right Insertion Loss	**-1.4**	**-2.2**	**-3.0**	**-3.1**	**0.0**	**1.9**	**3.2**	**10.0**	**15.1**	**12.6**	**14.6**	**17.8**	**25.7**
Insertion Loss	**4.7**	**4.9**	**3.5**	**3.4**	**6.0**	**7.6**	**8.1**	**12.8**	**16.5**	**13.5**	**16.7**	**22.2**	**28.8**

Table J-19. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 24.

Left	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.4	94.6	97.1	98.3	101.4	103.2	98.9	99.0	96.3	87.4	87.6	75.7	110	110
Test 2	92.6	94.2	97.6	98.9	100.4	103.0	98.8	98.1	96.0	88.0	87.9	74.5	110	110
Test 3	92.3	94.1	97.7	99.1	100.1	103.6	99.6	98.5	96.5	87.5	87.2	74.5	110	110
Mean	92.4	94.3	97.5	98.8	100.6	103.3	99.1	98.5	96.3	87.6	87.6	74.9	110	110
Occluded														
Test 1	58.7	61.9	66.7	62.0	51.4	49.0	48.6	45.5	42.6	44.7	46.9	49.4	89	81
Test 2	57.8	61.5	66.3	62.9	52.4	50.1	49.6	47.2	43.1	45.2	46.9	49.4	89	81
Test 3	58.3	61.9	66.8	63.0	53.1	50.4	49.4	47.3	42.4	44.2	46.3	48.8	88	81
Mean	58.3	61.8	66.6	62.6	52.3	49.8	49.2	46.7	42.7	44.7	46.7	49.2	88	81
Left Insertion Loss	**34.2**	**32.5**	**30.9**	**36.2**	**48.3**	**53.4**	**49.9**	**51.9**	**53.5**	**42.9**	**40.9**	**25.7**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	92.0	95.1	95.5	96.9	99.5	102.8	100.4	102.6	98.3	92.9	87.8	79.9	110	110
Test 2	91.2	94.5	96.0	97.8	99.5	102.7	101.0	101.6	99.3	93.8	87.2	79.5	110	110
Test 3	91.1	95.0	96.2	98.2	99.5	103.3	101.8	101.1	97.8	91.9	87.5	79.7	110	110
Mean	91.4	94.9	95.9	97.6	99.5	102.9	101.1	101.8	98.5	92.9	87.5	79.7	110	
Occluded														
Test 1	63.6	66.0	70.3	63.7	52.9	55.3	53.9	51.0	48.5	51.6	54.4	57.1	98	86
Test 2	63.5	64.4	69.1	62.9	55.0	56.7	56.1	52.9	48.9	51.6	54.5	57.1	98	86
Test 3	63.1	64.9	69.1	63.5	55.5	55.2	54.2	50.9	48.6	51.4	54.3	56.9	98	86
Mean	63.4	65.1	69.5	63.4	54.5	55.8	54.7	51.6	48.7	51.5	54.4	57.0	98	86
Right Insertion Loss	**28.0**	**29.8**	**26.4**	**34.3**	**45.1**	**47.2**	**46.4**	**50.2**	**49.8**	**41.4**	**33.1**	**22.7**		
Insertion Loss	**31.1**	**31.1**	**28.6**	**35.2**	**46.7**	**50.3**	**48.1**	**51.0**	**51.7**	**42.1**	**37.0**	**24.2**		

Table J-20. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 25.

Left	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.3	89.7	86.0	88.6	89.4	91.6	88.0	91.2	91.8	93.5	94.7	93.5	93.6
Test 2	86.3	89.9	86.0	88.6	89.5	91.9	88.7	89.9	91.7	92.9	94.9	94.6	95.3
Test 3	86.7	90.2	86.0	88.6	89.5	91.2	89.2	89.7	91.0	92.7	95.4	94.2	95.8
Mean	86.4	89.9	86.0	88.6	89.5	91.6	88.6	90.2	91.5	93.0	95.0	94.1	94.9
Occluded													
Test 1	79.4	81.4	78.3	80.8	80.7	81.3	78.3	76.3	75.7	79.2	76.3	71.1	65.4
Test 2	86.7	89.4	85.5	88.0	86.5	87.4	84.3	79.8	76.2	79.8	76.4	72.1	66.6
Test 3	86.8	89.7	85.7	88.3	87.4	87.6	84.5	80.7	75.1	78.7	76.9	72.8	68.2
Mean	84.3	86.8	83.2	85.7	84.9	85.4	82.4	78.9	75.7	79.2	76.5	72.0	66.7
Left Insertion Loss	**2.1**	**3.1**	**2.8**	**2.9**	**4.6**	**6.1**	**6.2**	**11.3**	**15.8**	**13.8**	**18.5**	**22.1**	**28.2**
Right	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**
Unoccluded													
Test 1	86.0	88.6	84.6	87.7	89.0	90.9	87.2	92.1	89.5	92.0	93.2	92.8	94.3
Test 2	86.2	89.0	84.6	87.6	89.2	90.4	87.1	91.2	89.4	92.7	92.5	92.5	94.7
Test 3	86.3	89.0	84.3	87.5	89.1	90.4	88.1	91.1	89.3	92.3	93.3	92.0	94.6
Mean	86.1	88.9	84.5	87.6	89.1	90.6	87.5	91.5	89.4	92.4	93.0	92.4	94.5
Error													
Occluded													
Test 1	87.0	90.0	86.7	91.0	93.7	95.4	96.2	93.8	86.7	85.7	82.3	79.0	74.9
Test 2	86.7	89.6	86.4	90.4	92.8	95.2	97.3	95.4	88.9	87.0	83.7	78.8	75.2
Test 3	86.8	90.0	86.7	90.8	93.7	95.4	95.7	92.7	85.8	85.3	82.2	77.5	73.8
Mean	86.8	89.8	86.6	90.7	93.4	95.3	96.4	94.0	87.2	86.0	82.7	78.4	74.6
Right Insertion Loss	**-0.7**	**-1.0**	**-2.1**	**-3.1**	**-4.3**	**-4.8**	**-8.9**	**-2.5**	**2.3**	**6.4**	**10.3**	**14.0**	**19.9**
Insertion Loss	**0.7**	**1.1**	**0.3**	**-0.1**	**0.2**	**0.7**	**-1.3**	**4.4**	**9.0**	**10.1**	**14.4**	**18.0**	**24.0**

Table J-20. Raw data for ANSI S12.42-1995 (R1999) MIRE evaluations of the Thales Avionics Topowl® HMSD – Subject 25.

Left	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12500	16000	LIN	Awt
Unoccluded														
Test 1	90.7	94.0	96.3	96.6	98.4	100.3	98.4	96.4	92.8	84.2	84.9	76.4	108	108
Test 2	91.8	94.8	96.9	98.0	98.7	100.4	98.7	97.1	94.0	85.7	86.3	77.0	108	109
Test 3	91.6	94.6	96.8	97.6	98.2	100.0	99.0	97.8	94.3	86.4	86.8	75.5	108	108
Mean	91.3	94.5	96.7	97.4	98.4	100.3	98.7	97.1	93.7	85.4	86.0	76.3	108	108
Occluded														
Test 1	57.8	63.0	69.0	63.1	54.0	54.1	52.4	46.9	44.2	43.2	46.7	48.1	90	82
Test 2	58.3	62.0	68.2	63.1	55.9	56.3	56.8	51.5	52.7	45.9	45.3	47.0	96	84
Test 3	58.9	61.7	68.1	63.0	53.5	52.1	56.1	52.4	52.7	43.9	44.8	47.1	96	84
Mean	58.3	62.2	68.5	63.0	54.4	54.2	55.1	50.2	49.9	44.3	45.6	47.4	94	83
Left Insertion Loss	**33.0**	**32.2**	**28.2**	**34.3**	**44.0**	**46.1**	**43.6**	**46.9**	**43.8**	**41.1**	**40.4**	**28.9**		
Right	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12500**	**16000**	**LIN**	**Awt**
Unoccluded														
Test 1	91.6	94.0	97.2	97.6	98.9	101.2	100.5	100.0	97.1	94.0	89.7	76.5	109	109
Test 2	91.1	94.0	96.3	97.0	97.6	101.0	100.5	99.7	96.8	94.2	90.4	77.6	109	109
Test 3	91.9	94.1	96.2	97.1	97.7	100.3	99.5	98.5	96.6	96.1	91.1	78.3	109	109
Mean	91.5	94.0	96.6	97.2	98.1	100.8	100.2	99.4	96.8	94.8	90.4	77.5	109	
Occluded														
Test 1	67.1	62.7	72.5	67.3	60.2	62.8	60.6	59.1	58.6	58.4	60.2	56.8	102	94
Test 2	69.1	66.2	76.1	72.7	64.1	70.0	75.3	66.2	68.6	64.4	58.5	56.4	103	95
Test 3	65.7	62.8	71.5	66.7	61.4	62.9	60.3	62.5	61.9	60.5	57.4	56.5	102	93
Mean	67.3	63.9	73.4	68.9	61.9	65.2	65.4	62.6	63.0	61.1	58.7	56.6	102	94
Right Insertion Loss	**24.2**	**30.1**	**23.2**	**28.3**	**36.2**	**35.6**	**34.8**	**36.8**	**33.8**	**33.7**	**31.7**	**20.9**		
Insertion Loss	**28.6**	**31.2**	**25.7**	**31.3**	**40.1**	**40.8**	**39.2**	**41.8**	**38.8**	**37.4**	**36.1**	**24.9**		

Appendix K.

Subject head and ear measurement demographics and fitting notes.

As noted in the Methods section, 13 helmet liners were delivered with the Topowl® HMSD helmets for evaluation. The "Helmet Liner ID" column in Appendix K specifies which of the 13 helmet liners were used to obtain the best helmet fit and therefore used during sound attenuation measurements. Likewise, the "Felt Liner" and "Nape Pad" columns specify which liner and nape pad were used for best fit. The characteristics of these accessories are not presented in this report.

The test sequence column presents the order of testing for the three conditions. "O" and "U" represent the real-ear-attenuation-at-threshold (REAT) occluded and unoccluded evaluations of the Topowl® alone. "O/C" and "U/C" denote the REAT occluded and unoccluded evaluations of the Topowl® with the CEP. The letter "M" represents the ANSI S12.42-1995 (R1999) Microphone-in-real-ear measurements (MIRE). For example, for Subject 1 the Topowl® helmet alone was tested using the REAT procedure, beginning with the occluded (i.e., helmet on) threshold measurement. Next, the helmet with CEP configuration was tested, followed by the MIRE evaluation. The MIRE evaluation always began with an unoccluded measurement. Subject 4 was used only for REAT evaluation of the Topowl® with CEP combination, beginning with the occluded measurement.

Subject head and ear measurement demographics and fitting notes.															
Subject	**Gender**	**Bitragion Width (mm)**	**Head Height (mm)**	**Ear Canal Size (L/R)**	**Helmet Size**	**Helmet Spacers (L / R)**	**Helmet Liner ID**	**Felt Liner**	**Nape Pad**	**Test Sequence**					
1	M	138	132	L / L	6	0 / 0	OCONNOR 18/06/03	500741 M-L	500350 S	O	U	U/C	O/C	M	
2	M	138	134	M / L	6	2 / 2	OCONNOR	500739 M	500350 S	O/C	U/C	O	U	M	
3	M	137	138	M / L	4	1 / 1	DOT 218 LARGE	500741 M-L	500350 M	O	U	M	O/C	U/C	
4	M	138	138	L / L	4	1 / 1	DOT 218 LARGE	500741 M-L	500350 M	O/C	U/C				
5	F	124	138	S / S	6	3 / 3	OCONNOR	500741 M-L	500350 S	U/C	O/C				
6	M	138	138	M / L	6	2 / 2		500741 M-L	500350 S	U	O	O/C	U/C	M	
7	M	144	146	L / L	4	1 / 1	WITTE 18/06/03	500741 M-L	500350 M	O	U	U/C	O/C	M	
8	M	146	144	XL / XL	6	0 / 0	OCONNOR	500741 M-L	500350 S	O/C	U/C	U	C	M	
9	M	138	150	L / XL	4	0 / 0	DOT 218 LARGE			M					
10	M				4	0 / 0	DOT 218 LARGE	500741 M-L	500350 M	M					
11	M	146	140	M / L	6	3 / 3	DOT 218 LARGE	500741 M-L	500350 S	O/C	U/C	M	U	O	
12	F	138	138	L / L	4	4 / 4	DENNIS 18/06/03	500741 M-L	500350 M	O	U	U/C	O/C	M	
13	M	142	144	L / L	6	0 / 0	WITTE 18/06/03	500741 M-L	500350 S	O/C	U/C	U	O/C	M	
14	M	155	135	M / M	6	0 / 0	OCONNOR 18/06/03			ABORTED					
15	M	148	138	M / L	4	0 / 0	DOT 218 LARGE 70g/I	500741 M-L	500350 S	O	U	U/C	O/C	M	
16	M	160	138	L / L	6	1 / 1	RICH 16/06/03	500741 M-L	500350 S	O/C	U/C	U	O/C	M	
17	F	138	130	M / M	4	2 / 2	WITTE 18/06/03	500741 M-L	500350 XS	O	U	U/C	O/C	M	
18	M	150	136	L / XL	6	1 / 1	ADAMS LARGE 15/12/02	500741 M-L	500350 S	O/C	U/C	U	O/C	M	
19	M	146	135	M / M	4	2 / 2	ADAM LARGE 26/11/02	500741 M-L	500350 S	O	U	U/C	O/C	M	
20	M	143	133	M / M	6	0 / 0	ADAM LARGE 26/11/02	500741 M-L	500350 M	O/C	U/C	U	O/C	M	
21	M	141	160	L / L	4	0 / 0	HYBRID III 20/11/02	500741 M-L	500350 M	O	U	U/C	O/C	M	
22	F	140	140	M / M	6	0 / 0	WITTE 18/06/03	500741 M-L	500350 XS	O/C	U/C	U	O	M	
23	F	155	130	L / L	4	3 / 3	OCONNOR 18/06/03	500741 M-L	500350 M	O	U	U/C	O/C	M	
24	M	145	146	L / L	6	0 / 0	DENNIS 18/06/03	500741 M-L	500350 M	M	O/C	U/C	U	O	
25	M	140	147	ML / ML	6	0 / 0	DENNIS 18/06/03			M					